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Research Paper

English as a Foreign Language Preservice Teachers' Technological Pedagogical Content Knowledge: A Quantitative Comparative Study

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Abstract

Technological pedagogical and content knowledge (TPACK) is a set of knowledge domains that can help maximize teachers' successful technology use in education. Recent directions in educational technology research have moved towards investigating teachers' TPACK in content-specific applications. This study initially intended to compare and contrast English as a foreign language (EFL) preservice teachers' (PSTs') TPACK perceptions in the contexts of Iran and Oman. It also sought to examine if there was a gender gap in EFL PSTs' TPACK perceptions in these contexts. A quantitative comparative research design was used to collect the data via online questionnaires from EFL PSTs in Iran and Oman. Results showed that EFL PSTs generally had high perceptions of their TPACK; however, the Iranian EFL PSTs' TPACK perceptions were significantly higher than those of the Omani EFL PSTs in all subdomains of TPACK. The study also reported that there were no significant differences between genders in Oman, Iran, and collectively all the participants regardless of their nationality. Findings provide practical pedagogical implications for future EFL PSTs, EFL PST educators, EFL curriculum reformers, and policymakers in considering context-sensitive decisions such as needs-customized courses and activities with preevaluation of tools and abilities entailed.

Keywords: Technological Pedagogical and Content Knowledge (TPACK); Preservice English as a Foreign Language Teachers (PSTs); Perceptions; Gender; Academic Year; Iran; Oman.

1. Introduction

Human-technology relationship has grown incredibly fast, reaching 4.66 billion active Internet users worldwide (Johnson, 2021), revolutionizing countless domains of life, including education, among others. Technology integration, thus, has been a main criterion recognized in education reform discourse (Li, 2018), which can ultimately bolster the education sector by, as Richards (2017) proposed, providing support for teachers (e.g., providing learner-centered activities, real-world content, monitoring, support, etc.), students (e.g., exposure, flexibility, autonomy, motivation, active learning, etc.), and institutions (e.g., simplified administration, improved outcomes, flexible curriculum, etc.). This growth of technology as a popular commodity in education (Jang & Tsai, 2013), however, does not necessarily end in, or expedite, the effective use of technology in the educational arena (Tondeur et al., 2016). This is mainly rooted in the narrow focus on technology (Tondeur et al., 2016) and that technology skills being taught and learned divorced from context and pedagogy, which may, in turn, hinder teachers' ability to appreciate the intricacies of technology in relation to context and pedagogy (Angeli et al., 2016). What can be inferred, therefore, is that successful and adequate technology adoption in the realm of education is much more complicated than simply supplying computers and connecting them to the Internet (Tondeur et al., 2017). It is in this pursuit that there have been many attempts to soundly integrate technology into

education by introducing different frameworks and models that map the intricacies and interplay of infusing technology in the education sector. One of the most popular frameworks introduced to account for the complexity of technology adoption in education is the technological pedagogical content knowledge (TPCK/TPACK) framework proposed by Koehler and Mishra (2006). The TPACK framework grew out of Shulman's (1987) seminal study, which theorized pedagogical content knowledge (PCK) as an interlacing set of knowledge domains vital for teachers to develop (Öz, 2015). TPACK, therefore, is a framework positing that teaching with technology is good only when teachers draw on a set of knowledge bases (i.e., technology knowledge [TK]), pedagogy knowledge (PK), and content knowledge (CK)) and be able to observe the connections between and among these knowledge bases.

TPACK has fast become a fundamental model embraced by numerous researchers across different domains specific to content and context (Wang et al., 2018). Despite this growth, scholarship of TPACK integration into EFL curriculum has been behindhand in aiding teachers, contrary to the TPACK research communities across other content-specific TPACK research communities. This goes against the fact that several researchers have stressed the importance of aligning technology, pedagogy, content, and curriculum in preparing preservice teachers (PSTs) for the 21st century (Tondeur et al., 2016; Tseng, 2018). Consequently, the sparseness of research on TPACK in EFL PSTs (Öz, 2015), along with discord in research findings regarding gender and TPACK perceptions, and conflicting findings in different contexts makes it imperative that the target research community invest in TPACK scholarship to help outline theoretically meaningful technology integration patterns that help policymakers, curriculum developers, teacher educators, and teachers (preservice as well as in-service teachers) reconsider effective technology adoption praxes in ELT by contributing to the literature and complementing previous research from a fresh perspective. To this end, the following research questions stand out:

1. Are there any significant differences between Iranian and Omani EFL PSTs with regard to their TPACK perceptions?

2. Are there any significant differences in the participants' TPACK perceptions by gender in Oman, Iran, or collectively?

3. Are there any significant differences in the participants' perceptions in different academic years in Oman, Iran, or collectively?

2. Literature Review

2.1. TPACK

TPCK (later changed into TPACK; Thompson & Mishra, 2007) release back in 2006 was an upshot of the atheoretical nature of technology integration (Angeli et al., 2016). Meanwhile, a large number of researchers' aspirations were overwhelming due to a deficit in or improper use of theoretical underpinnings (Passey, 2019), "producing shallow analyses that do little to inform the practice of education" (Bennett & Oliver, 2011, p. 179). TPACK is a framework that has broadened Shulman's PCK framework, a concept that Shulman has put forth to reset the standards of a qualified teacher (Nazari et al., 2019). It was indeed designed to offer a "common language in talking about teaching, learning, and technology" (Wang et al., 2018, p. 235) in the educational technology research field (Angeli & Valanides, 2009; Koehler & Mishra, 2006; Mishra & Koehler, 2009). Based on Shulman's (1986) conception, the success of a teacher lies in not only their CK and PK (PK and CK, respectively), but also in the knowledge formed as a result of the reciprocal synergy between CK and PK, that is, PCK (Shulman, 1987). PCK, therefore, refers to teachers' body of knowledge of how a subject matter, or a piece of subject matter, that is, C(ontnet), is best transformed through P(edagogy) to scaffold the teaching and or learning processes (Bostancıoğlu & Handley, 2018; Shulman, 1986).

TPACK amounts to seven highly interactive domains of knowledge that teachers need to draw on to teach specific content using emerging technologies as thoughtfully, meaningfully, efficiently, and effectively as possible (Angeli & Valanides, 2009; Mishra & Koehler, 2009). Koehler and Mishra (2006) point out that effective teaching with technology is heavily reliant on teachers' TK, PK, and CK, technological content knowledge (i.e., TCK), technological pedagogical knowledge (i.e., TPK), and TPCK (later reabbreviated as TPACK in Thompson & Mishra, 2007).

2.2. EFL PSTs' TPACK Perceptions

The literature has witnessed a limited number of studies devoted to the examination of EFL PSTs' perceptions of their TPACK (Atar et al., 2019; Chai, Koh, & Tsai, 2010; Ekrem & Recep, 2014; Ersanli, 2016; İşler & Yıldırım, 2018; Mashhadi et al., 2023; Monjezi et al., 2021; Nazari et al., 2019; Öz, 2015; Sarıçoban et al., 2019). Whereas Tseng et al.'s (2020) review of language teachers in general reported different levels of TPACK, in their study on 182 EFL PSTs, Atar et al. (2019) found that the participants' TPACK was high. This harmonizes with Sarıçoban et al. (2019) who reported a satisfactory level of TPACK in 77 EFL PSTs. In a similar study, Öz (2015) maintained that EFL PSTs perceived themselves to have high levels of TPACK. Also, İşler and Yıldırım's (2018) quantitative study on 94 EFL PSTs suggested high levels of TPACK perceptions. İşler and Yıldırım's (2018) study was further coupled with qualitative evidence supporting the quantitative results that participants' TPACK was high.

2.3. TPACK and Gender

Gender was another theme that has appeared in some studies (Atar et al., 2019; Ekrem & Recep, 2014; Ersanli, 2016; Mashhadi et al., 2022; Sarıçoban et al., 2019). Atar et al. (2019) revealed that gender does not have a significant influence; nonetheless, Öz's (2015) findings resonate with differences between genders in how males and females perceive themselves, especially in terms of PK and TK. Öz's (2015) study revealed that the males' PSTs TK perceptions were significantly higher, whereas the females' PK perceptions were significantly higher. Likewise, Sarıçoban et al. (2019) confirmed that the males perceived themselves to have significantly higher TK than the females.

In a similar research strand, Koh et al. (2010) investigated 1185 Singaporean PSTs' TPACK, and the results showed differences in how both sexes perceived their TPACK. The analyses of the results of gender influence on TPACK perceptions suggested that the male PSTs generally rated themselves higher than the females in TK, CK, and KTT (i.e., knowledge of teaching with technology). Later, doing the effect size procedure, they found that the CK and TKK were not as significant as it would mark a huge difference; TK, however, was still as statistically significant as in other studies (Ersanli, 2016; Öz, 2015; Sarıçoban et al., 2019).

The studies above are in congruence with the pretest findings of Ersanli's (2016) experimental study, showing that males started with higher TK perceptions. Interestingly enough, although males have ended with significantly higher TK confidence, they were lower than females, who ended with staggeringly significant TK compared to their pretests after a 5-week workshop. In contrast, some studies revealed little or no difference between both genders in terms of their TPACK perceptions. Koh and Chai (2011), for instance, studied Singaporean PSTs' TPACK perceptions and concluded that there were no statistically significant differences between males and females. This is in line with Horzum's (2013) findings on 239 PSTs in different disciplines (e.g., social studies education, science education, computer education, and instructional technology) at the Sakarya University Faculty of Education in Turkey, showing no significant differences between males and females in their TPACK perceptions. This was also the case in Al-Abdullatif's (2019) report of 113 PSTs from different disciplines in Saudi Arabia; however, there were many more female participants (82.3%) than males (17.7%) in their study. The discord in research findings regarding EFL PSTs' TPACK perceptions does not show one clear pattern; however, there is only one trend that has recurred in more studies in the literature, and it is the case of higher technology knowledge perceptions in favor of male EFL PSTs.

3. Methodology

3.1. Research Design

In line with its questions, this study was comparative in essence, using quantitative methods, based on an online survey method. The research variables included PSTs' TPACK perceptions, gender, nationality, and academic year.

3.2. Participants

EFL PSTs from different universities in Iran and Oman were invited to complete an online questionnaire on their TPACK perceptions through an announcement that asked for voluntary participation. A criterion sampling technique was adopted to maximize the chances of obtaining a more representative sample of the population. The participants included 443 male and female EFL PSTs, 293 of whom were from major Iranian universities and 150 from Sohar University, and Sultan Qaboos University in Oman. They were all student teachers and enrolled as EFL prospective teachers were

included to complete the online questionnaire on Google Forms. The sample size was, then, double-checked against the normal distribution of the data to examine whether it could be representative of the population. The two contexts of Iran and Oman were chosen because they could richly involve both analysis and synthesis of similarities/differences in PSTs' TPACK due to the sociocultural, socioeconomic, and educational differences between the contexts of interest.

3.3. Instrumentation

This study adopted the TPACK-EFL questionnaire (see the Appendix) developed and validated by Baser et al., (2015). The questionnaire was preferred over other TPACK questionnaires because it was developed specifically for preservice language teachers, whereas other questionnaires were either developed for teachers (and not preservice teachers), or did not target language teachers in specific. Some minor changes were then applied to some examples of some questions due to the nature of changing technologies and the fact that there are now newer tools replacing older ones. For instance, the examples in Question 8 were extended from "I can use collaboration tools (wiki, Edmodo, 3D virtual environments, etc.) in accordance with my objectives" to "I can use collaboration tools (Google Forms, Google Drive, wiki, Edmodo, 3D virtual environments, etc.) in accordance with my objectives."

Although robustly developed, the questionnaire was checked for both face validity and content validity by three experts in educational technology and applied linguistics, two of whom from Shahid Chamran University of Ahvaz (Iran) and one from Sohar University (Oman). Having been deemed fit, the questionnaire was then piloted against 30 EFL PSTs from each country other than the participants of the study to account for the reliability of the instrument. The Cronbach's alpha statistical analyses of the internal consistency of the questionnaire items in each context indicated a high-reliability index. The reliability coefficient for the questionnaire in the Iranian context was .970, and for the Omani context was .966, respectively.

3.4. Procedure

To garner data on the participants' TPACK perceptions, the researchers shared the survey link with voluntary participants to help protect them from any possible danger associated with the COVID-19 pandemic. The first part of the questionnaire introduced the questionnaire, the purpose of the study, and individuals who would benefit from the study, and specified the time estimated to complete the questionnaire. It also ensured that the respondents' identity will be kept confidential from any third-party organization/person. The second part included the TPACK-EFL questionnaire (Baser et al., 2015), which was divided into seven sections (including 39 questions), namely: TK, CK, PK, PCK, TCK, TPK, TPACK. The factual questions, including nationality, gender, and the study year at college (i.e., freshman, sophomore, junior, and senior), were given as a third part, following the advice of Dornëy and Csizér (2012), to avoid privacy second-thoughts that respondents might develop if they see personal questions at the start of the questionnaire. The questionnaire link was then shared with students through Google Forms, and 443 EFL PST completed the survey ($N = 293$ from Iran, and $N = 150$ from Oman).

4. Results

The data garnered were analyzed using descriptive and inferential statistics. Independent samples t tests were run to test the significance of the TPACK and its components in the two countries as independent samples. The effect size for the t-test procedure was then checked against Cohen's d effect size to check for the practicality of the significant results. The same procedures were employed to outline if there was a significant difference between male and female EFL PSTs in Iran, Oman, and all male and female EFL PSTs, regardless of their nationality. The study also sought to investigate whether student teachers' academic year of study showed a particular significance or pattern through one-way analysis of variance (ANOVA).

There were 443 participants in this study, with a distribution of 66.1% ($N = 293$) from Iran (66.1%) and 150 from Oman (33.9%), including 215 male (48.5%) and 228 female respondents (51.5%). Males comprised 60.1% ($N = 176$) of the distribution of the Iranian EFL PSTs in the Iranian context, whereas females comprised 39.9% ($N = 117$). Omani male respondents, on the other hand, represented 26% ($N = 39$) of the data, whereas females were almost three times higher (74%, $N = 111$).

To answer the first research question seeking any significant differences between the Iranian and Omani EFL PSTs' perceptions, as can be seen in the first field of Table 1., there was a significant difference in all TPACK dimensions in favor of Iranian EFL PSTs with the following effect sizes: a small significant difference in CK (.2-.4), a small to a medium significant difference in TPK, TK and TPACK domains (.2-.6), and a medium-large significant difference in PK, PCK, and TCK (.3-.7).

As regards the second research question on any gender differences between all participants collectively, the results of the *t* test, shown in the second field of Table 1, suggest that there was no significant difference between the male and female EFL PSTs' perceptions in their TPACK considering both countries as one. However, the Iranian female EFL PSTs had significantly higher perceptions in the TPACK domain than the Iranian male EFL PSTs, with a small to moderate (.499-.30) effect size. In Oman, on the other hand, the *t*-test results did not show any significant difference between the Omani male and female EFL PSTs in all TPACK domains:

Table 1. *Comparisons Between Iranian and Omani EFL PSTs' TPACK Perceptions*

	Iranian and Omani EFL PSTs' TPACK Perceptions			TPACK Perceptions by Male and Female EFL PSTs			Gender Difference Between Iranian Male and Female EFL PSTs TPACK Perceptions			Gender Difference Between Omani Male and Female EFL PSTs TPACK Perceptions		
	t	*df*	*Sig.*	*t*	*df*	*Sig.*	*t*	*df*	*Sig.*	*t*	*df*	*Sig.*
TK	4.179	441	.000	1.447	441	.149	.029	291	.977	.199	148	.842
CK	2.098	441	.037	.807	441	.420	.372	291	.710	-.322	148	.748
PK	4.967	244.397	.000	.040	441	.968	-1.455	291	.147	-1.084	148	.280
PCK	5.187	241.573	.000	1.776	441	.076	-.272	291	.786	.349	148	.728
TCK	5.345	441	.000	1.084	441	.279	-.460	291	.646	-.463	148	.644
TPK	4.911	441	.000	.306	441	.760	-1.047	291	.296	-.857	148	.393
TPACK	4.109	441	.000	-1.094	441	.275	-2.220	291	.027	-1.362	148	.175

The third research question examined whether EFL PSTs showed any similarities or differences in their TPACK perceptions in different academic years. As shown in Table 2, no statistically significant difference was reported between all the participants in both countries in terms of their TPACK perceptions in different academic years. However, when each country was tested on its own, there was a significant difference between Iranian participants' perceptions of TK and TPACK domains (see Table 2):

Table 2. *Comparing Participants' TPACK Domains Based on Academic Year*

	All Participants		Iranian Participants		Omani Participants	
	F	*Sig.*	*F*	*Sig.*	*F*	*Sig.*
TK	2.534	.056	3.517	.016	.499	.684
CK	1.983	.116	.674	.569	4.955	.003
PK	.241	.868	.841	.472	.459	.711
PCK	.433	.730	.813	.487	2.256	.084
TCK	.648	.585	3.094	.027	1.061	.368
TPK	.312	.817	2.124	.097	.908	.439
TPACK	.865	.459	2.994	.031	.830	.479

Further ANOVA tests considering the Iranian participants in Table 3 showed that the significant difference in TK was between the Iranian juniors and freshmen (*p* > .007), while for TPACK, the statistically significant difference was between the Iranian sophomores and seniors (*p* > .025). The Omani participants, on the other hand, showed a significant difference in CK between the seniors and freshmen (*p* > .049), and also between the sophomores and juniors (*p* > .027; see Table 3):

Table 3. *Comparing Subgroups of Iranian and Omani Participants*

Nationality	Dependent Variable	(I) Academic Year	(J) Academic Year	Mean Difference (I-J)	*Sig.*	Cohen's *d*
Iranian	TK	freshman	sophomore	-1.646	.910	
			junior	-6.121*	.007	
			senior	-2.115	.724	
		sophomore	freshman	1.646	.910	
			junior	-4.476	.348	

Shahid Chamran University of Ahvaz

			senior	-.469	.998	
		junior	freshman	6.121*	.007	
			sophomore	4.476	.348	
			senior	4.006	.302	
		senior	freshman	2.115	.724	
			sophomore	.469	.998	
			junior	-4.006	.302	
	TCK	freshman	sophomore	-1.886	.103	
			junior	-1.269	.182	
			senior	.225	.987	
		sophomore	freshman	1.886	.103	
			junior	.617	.902	
			senior	2.110	.108	
		junior	freshman	1.269	.182	
			sophomore	-.617	.902	
			senior	1.494	.207	
		senior	freshman	-.225	.987	
			sophomore	-2.110	.108	
			junior	-1.494	.207	
	TPACK	freshman	sophomore	-1.851	.310	
			junior	-.548	.908	
			senior	1.577	.275	
		sophomore	freshman	1.851	.310	
			junior	1.303	.679	
			senior	3.428*	.025	
		junior	freshman	.548	.908	
			sophomore	-1.303	.679	
			senior	2.125	.142	
		senior	freshman	-1.577	.275	
			sophomore	-3.428*	.025	
			junior	-2.125	.142	
Omani	CK	freshman	sophomore	-.628	.967	
			junior	3.113	.069	
			senior	3.368*	.049	.243
		sophomore	freshman	.628	.967	
			junior	3.741*	.027	
			senior	3.997*	.019	
		junior	freshman	-3.113	.069	
			sophomore	-3.741*	.027	
			senior	.256	.997	
		senior	freshman	-3.368*	.049	
			sophomore	-3.997*	.019	
			junior	-.256	.997	

5. Discussion

Regarding the first research question, it was found that the Iranian EFL PSTs perceived themselves to have significantly higher perceptions than the Omani EFL PSTs in all TPACK domains. There could be some explanations as to why the Iranians' self-perceptions of their TPACK were significantly higher than the Omani EFL PSTs with moderate to strong effect sizes, especially in TK, PK, PCK, TCK, TPK, and TPACK. First, different national curriculums could probably inspire different awareness of TPACK in the two samples under investigation. This might be due to different curriculum content, pedagogical approaches, and digital tools (Harris et al., 2017). Second, the difference might also be embedded in the macrocontext level where socioeconomic and sociocultural differences like the economic conditions, the ability to afford teachers with different technology tools, the social conditions, the political climate or techno-educational policies affect teachers and technology use. Third, students' grade and having one's own technology for educational purposes could affect their perceived competency, as well. Based on Demitras and Mumcu (2021), as the

students' level increases, so too their potential in integrating technology. They also found that digital ownership for educational purposes significantly affected their digital competence and TPACK.

Turning to the second research question of whether there was a gender gap between PSTs' TPACK perceptions, the results reported no significant gender difference in EFL PSTs' perceptions of TPACK when all the male participants were compared to all the female participants in all TPACK domains. While supporting Atar et al.'s (2019) findings, this study was unable to support previous findings (e.g., Ekrem & Recep, 2014; Ersanli, 2016; Koh et al., 2010; Öz, 2015; Sarıçoban et al., 2019) that there was a significant gender difference in, at least, one TPACK dimension (i.e., TK higher for the male EFL PSTs). Although gender difference has no biological roots, there could be several possible explanations for this result. First, it can be attributable to the social, cultural, political, economic, and technological conditions of the contexts of interest; hence, different studies in different contexts may keep yielding differing results. Third, as most of the studies cited above (e.g., Ekrem & Recep, 2014; Ersanli, 2016; Öz, 2015; Sarıçoban et al., 2019) were in the context of Turkey; predictably, the results of the previous studies manifest similar results on gender differences as they studied the same population. Fourth, and most importantly, some authors (e.g., North & Noyes, 2002) have speculated that the gender gap may disappear with time as technology becomes more prevalent. This is supported by the fact that student teachers nowadays rely more on technology at university as the study was conducted in the critical COVID-19 condition, and most countries in the world, including the contexts under investigation, have turned to e-learning/teaching in almost all universities. This can especially be the case since the previously mentioned metaphor of digital residents or visitors posits that it is not about age, gender, or background that we observe different competencies or abilities; however, it is more about users' motivations and contexts (White & Le Cornu, 2011). It is noteworthy that this study also reported no significant statistical gender gap in all TPACK domains when the Omani context was studied independently. In the Iranian context, however, the female EFL PSTs' perceptions were significantly higher than the males' in the TPACK domain. However, Cohen's *d* test showed that the statistically significant difference that the *t* test reported was not practical, which can further corroborate the fact that the gender gap did not exist in this study.

The third research question investigated whether there was a significant difference between EFL PSTs' perceptions of TPACK based on their academic year. Between-groups results showed no significant difference between students in different academic years in terms of their perceptions of TPACK. However, when within-groups analyses for each country were conducted, the results showed that Iranian PSTs in different academic years had significant differences in how they perceived themselves in both TK (between juniors-freshmen) and TPACK (between seniors-sophomores). Likewise, ANOVA tests were performed for the Omani context and reported significant differences in how Omani PSTs perceived their CK. Specifically, significant differences existed between seniors/freshmen, seniors/sophomores, and juniors/sophomores. Overall, the results indicate nonlinear, difficult-to-predict patterns of self-perceptions of TPACK in different domains of TPACK. This is in line with Turgut's (2017) findings that different knowledge domains of TPACK may unfold in different times and manners. This study also suggests that different TPACK domains might also unfold variously in dissimilar contexts, which could make TPACK highly context-sensitive and that TPACK is "woven together with the contexts in which it is developed and enacted" (pp. 456-457; Rosenberg & Koehler, 2015).

6. Conclusion

One of the most important implications of this study is the general patternless variation the findings have shown regarding how EFL PSTs perceive their abilities in TPACK in two different countries. This points to the fact that two socioculturally different contexts with possible differences in their systems of education, infrastructure, economic status, and ideologies might mismatch in several ways. EFL PSTs, thus, might exhibit significantly different perceptions of themselves in some or all domains (e.g., PSTs' TPACK perceptions varied significantly in all of the domains in this study). As a practical implication, before starting an educational technology course or a workshop, teacher educators better assess students' perceptions of TPACK in the particular context so as to diagnose their strengths and weaknesses in different TPACK domains. Indeed, courses/workshops could specifically focus on authentic, hands-on, and level-specific activities aligned with students' strengths/weaknesses in different TPACK domains. It is also advised that curriculum reformers rethink the introduction and order of courses related to the content, pedagogy, and educational technology and whether they should be integrated as one course taught in tandem, or in succession.

As the mean scores for the PSTs in this study were particularly low in TCK, PCK, and TPACK domains, another practical implication for Iranian and Omani teacher educators would be that teacher educators need to encourage and

model the domains to their EFL student teachers to help them see the connections and interplay of all the domains in general, and PCK, TCK, and TPACK domains in particular. A key policy priority could therefore consider curriculum development in light of the recent findings regarding TPACK growth in EFL PSTs.

The findings related to the different patterns of EFL PSTs perceptions based on their academic year have also shown variation in significance both within groups (i.e., freshmen, sophomores, juniors, and seniors) and between contexts (i.e., that the significance level was totally different in the domains for the two countries). This has an important pedagogical implication on not relying on a one-size-fits-all program, and providing customized and needs-based instructions. Moreover, policymakers may need to think of localized decisions based on the elements in constant interaction in the target milieu.

Future research could attempt to complement the research with qualitative evidence with data drawn from performance-based assessments (e.g., creating lesson plans, designing tasks, and learning activities, etc.), interview measures, observation tools, or case studies (Archambault, 2016). It is also believed that comparative-qualitative, or comparative-mixed-methods design studies in the EFL context would provide critically important insights into the field and can take it one step forward. Besides, as this study compared two developing countries, more research is needed to determine PSTs/in-service EFL teachers' perceptions of their TPACK in two developed countries, or a developing vs. a developed country. Another important direction could also investigate the TPACK or the development of the TPACK in relation to teaching a specific language (sub)skill (e.g., listening, writing, grammar, vocabulary, etc.). More importantly though, more research is needed in relation to the TPACK growth in different milieux (i.e., how different domains develop and what strategies work the best in the EFL context).

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Data availability

The authors confirm that all the data collected or analyzed during this study are included in this published article.

Conflict of Interest

The authors declare they have no conflict of interest.

Ethical Approval

All the procedures performed in the study involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent

All the participants assented to participate in the research. They were informed about the purpose of the study prior to completing the survey.

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Appendix

TPACK-EFL Questionnaire by Baser, Kopcha, and Ozden (2015)

Items	How much can you do?								
	Nothing		*Very Little*		*Some Influence*		*Quite a Bit*		*A Great Deal*
TK									
1. I can use basic technological terms (e.g., operating systems, wireless connection, virtual memory, etc.) appropriately.	1	2	3	4	5	6	7	8	9

2. I can adjust computer settings such as installing software and establishing Internet connection.	1	2	3	4	5	6	7	8	9
3. I can use computer peripherals such as a printer, headphones, and a scanner.	1	2	3	4	5	6	7	8	9
4. I can troubleshoot common computer problems (e.g., printer problems, Internet connection problems, etc.) independently.	1	2	3	4	5	6	7	8	9
5. I can use digital classroom equipment such as projectors and smart boards.	1	2	3	4	5	6	7	8	9
6. I can use office programs (i.e., Word, PowerPoint, etc.) with a high level of proficiency.	1	2	3	4	5	6	7	8	9
7. I can create multimedia (e.g., video, web pages, etc.) using text, pictures, sound, video, and animation.	1	2	3	4	5	6	7	8	9
8. I can use collaboration tools (wiki, Edmodo, 3D virtual environments, etc.) in accordance with my objectives.	1	2	3	4	5	6	7	8	9
9. I can learn software that helps me complete a variety of tasks more efficiently.	1	2	3	4	5	6	7	8	9
CK									
10. I can express my ideas and feelings by speaking in English.	1	2	3	4	5	6	7	8	9
11. I can express my ideas and feelings by writing in English.	1	2	3	4	5	6	7	8	9
12. I can read texts written in English with the correct pronunciation.	1	2	3	4	5	6	7	8	9
13. I can understand texts written in English.	1	2	3	4	5	6	7	8	9
14. I can understand the speech of a native English speaker easily.	1	2	3	4	5	6	7	8	9
PK									
15. I can use teaching methods and techniques that are appropriate for a learning environment.	1	2	3	4	5	6	7	8	9
16. I can design a learning experience that is appropriate for the level of students.	1	2	3	4	5	6	7	8	9
17. I can support students' learning in accordance with their physical, mental, emotional, social, and cultural differences.	1	2	3	4	5	6	7	8	9
18. I can collaborate with school stakeholders (students, parents, teachers, etc.) to support students' learning.	1	2	3	4	5	6	7	8	9
19. I can reflect the experiences that I gain from professional development programs to my teaching process.	1	2	3	4	5	6	7	8	9
20. I can support students' out-of-class work to facilitate their self-regulated learning.	1	2	3	4	5	6	7	8	9
PCK									
21. I can manage a classroom learning environment.	1	2	3	4	5	6	7	8	9
22. I can evaluate students' learning processes.	1	2	3	4	5	6	7	8	9
23. I can use appropriate teaching methods and techniques to support students in developing their language skills.	1	2	3	4	5	6	7	8	9
24. I can prepare curricular activities that develop students' language skills.	1	2	3	4	5	6	7	8	9
25. I can adapt a lesson plan in accordance with students' language skill levels.	1	2	3	4	5	6	7	8	9
TCK									
26. I can take advantage of multimedia (e.g., video, slideshow, etc.) to express my ideas about various topics in English.	1	2	3	4	5	6	7	8	9
27. I can benefit from using technology (e.g., web conferencing and discussion forums) to contribute at a distance to multilingual communities.	1	2	3	4	5	6	7	8	9

Shahid Chamran University of Ahvaz

28. I can use collaboration tools to work collaboratively with foreign persons (e.g., Second Life, wiki, etc.).	1	2	3	4	5	6	7	8	9
TPK									
29. I can meet students' individualized needs by using information technologies.	1	2	3	4	5	6	7	8	9
30. I can lead students to use information technologies legally, ethically, safely, and with respect to copyrights.	1	2	3	4	5	6	7	8	9
31. I can support students as they use technology such as virtual discussion platforms to develop their higher order thinking abilities.	1	2	3	4	5	6	7	8	9
32. I can manage the classroom learning environment while using technology in the class.	1	2	3	4	5	6	7	8	9
33. I can decide when technology would benefit my teaching of specific English curricular standards.	1	2	3	4	5	6	7	8	9
34. I can design learning materials by using technology that supports students' language learning.	1	2	3	4	5	6	7	8	9
35. I can use multimedia such as videos and websites to support students' language learning.	1	2	3	4	5	6	7	8	9
TPACK									
36. I can use collaboration tools (e.g., wiki, 3D virtual environments, etc.) to support students' language learning.	1	2	3	4	5	6	7	8	9
37. I can support students as they use technology to support their development of language skills in an independent manner.	1	2	3	4	5	6	7	8	9
38. I can use Web 2.0 tools (animation tools, digital story tools, etc.) to develop students' language skills.	1	2	3	4	5	6	7	8	9
39. I can support my professional development by using technological tools and resources to continuously improve the language teaching process.	1	2	3	4	5	6	7	8	9