Assessing 21st-Century Technology Literacy Skills Among Turkish High School EFL Teachers

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Abstract

This study examines the 21st-century technology literacy skills of 13 EFL (English as a Foreign Language) teachers, focusing on their ability to comprehend, utilize, and maintain focus during interactions with technology in educational settings. Employing a quantitative research design, the investigation uses scales to measure three key dimensions: understanding technology, effective usage, and sustained attention. Participants completed the TPACK-21 questionnaire to evaluate their proficiency and attitudes toward technology integration in teaching. Data analysis was conducted with SPSS 27, incorporating descriptive statistics for summarization and inferential analyses to identify relationships, such as between teaching experience and technology skills. Findings illuminate EFL teachers' readiness for technology-driven education, highlighting strengths in pedagogical knowledge and basic technological familiarity, while pinpointing needs for improvement in content-specific integration and the synthesis of technology, pedagogy, and content. Key competencies addressed include technological knowledge technological content knowledge, and technological pedagogical content knowledge. The research provides practical recommendations for enhancing teacher training programs, fostering innovative, effective, and engaging strategies aligned with the demands of digital learners.

Keywords: 21st-century skills, technology literacy, EFL teachers, language education

Lise İngilizce Öğretmenlerinin 21. Yüzyıl Teknoloji Okuryazarlığı Becerilerinin Değerlendirilmesi

Özet

Bu çalışma, 13 İngilizceyi yabancı dil olarak öğreten (EFL) öğretmenin 21. yüzyıl teknoloji okuryazarlığı becerilerini incelemektedir. Araştırma, öğretmenlerin eğitim ortamlarında teknolojiyle etkileşim kurarken anlama, kullanma ve dikkatini sürdürme becerilerini değerlendirmeye odaklanmaktadır. Nicel bir araştırma deseni benimsenmiş ve öğretmenlerin teknoloji okuryazarlığını üç temel boyutta ölçmek için ölçekler kullanılmıştır: teknolojiyi anlama, teknolojiyi etkili biçimde kullanma ve teknolojiyle etkileşim sırasında dikkati sürdürme. Katılımcılar, öğretim süreçlerine teknolojiyi entegre etme yeterliklerini ve tutumlarını değerlendirmek amacıyla TPACK-21 anketini doldurmuşlardır. Veriler SPSS 27 programı ile analiz edilmiş; bulguların özetlenmesinde betimsel istatistikler, değişkenler arasındaki ilişkileri belirlemede ise (örneğin öğretim deneyimi ile teknoloji becerileri arasındaki ilişki) çıkarımsal analizler kullanılmıştır. Elde edilen sonuçlar, EFL öğretmenlerinin teknoloji temelli eğitime hazır olduklarını göstermekte; pedagojik bilgi ve temel teknolojik yeterliklerde güçlü olduklarını, ancak içeriğe özgü entegrasyon ve teknoloji-pedagoji-içerik sentezinde gelişime ihtiyaç duyduklarını ortaya koymaktadır. Çalışmada ele alınan temel yeterlikler arasında teknolojik bilgi, teknolojik içerik bilgisi ve teknolojik pedagojik içerik bilgisi yer almaktadır.

Anahtar Sözcükler: 21inci yüzyıl becerileri, teknoloji okuryazarlığı, İngilizce öğretmenleri, dil eğitimi

1. Introduction

In the evolving landscape of 21st-century education, EFL (English as a Foreign Language) teachers are increasingly expected to integrate technology effectively into their pedagogy. The Technological Pedagogical Content Knowledge (TPACK) framework, comprising seven knowledge domains: Technological Knowledge (TK), Pedagogical Knowledge (PK), Content Knowledge (CK), Pedagogical Content Knowledge (PCK), Technological Pedagogical Knowledge (TPK), Technological Content Knowledge (TCK), and Technological Pedagogical Content Knowledge (TPACK), offers a comprehensive structure for evaluating teachers' capacity to blend these elements for enhanced instruction. Numerous studies have found that EFL teachers generally report higher confidence in TK and PK, but often rate their TPCK and TCK skills lower, indicating a gap in fully integrating technological tools with content and pedagogy (Susanti et al., 2023; Quyen, 2022; Ningtyas et al., 2023). These disparities are critical when viewed through the lens of 21st-century competencies, which prioritize critical thinking, collaboration, creativity, and communication.

Another key dimension influencing TPACK competency is teaching experience. The studies underlined a positive correlation between years of teaching experience and greater self-efficacy in TPACK domains, particularly when paired with professional development opportunities (Lailiyah, 2017; Antony et al., 2019; Purba et al., 2023). Experienced teachers are often more adept at aligning technological tools with pedagogical goals and content needs. However, even seasoned educators (those with many years of teaching practice and a strong foundation in traditional pedagogical methods) may struggle with integrating newer digital tools unless given structured opportunities for professional growth and upskilling (Jamila & Basya, 2024). Identifying which TPACK components teachers excel in, and which remain underdeveloped, is crucial for designing effective professional development that strengthens weaker areas while leveraging existing strengths. This targeted approach ensures that EFL instruction remains aligned with global educational goals and the demands of modern learners.

1.1. TPACK

The inclusion of the technological pedagogical content knowledge (TPACK) framework in English language teaching is seen as a transformative way to prepare teachers for 21st century classrooms. Evidence from various educational contexts has demonstrated that EFL teachers create TPACK through engaged participation in dynamic learning systems and digital learning platforms. For example, a study of college-level EFL teachers in China revealed that their TPACK developed through their interactions within and across different online teaching systems. The authors of this research highlighted that TPACK is created through a complex interplay of cultural, social, and technological influences, and TPACK development is indeed not static (Chen, Li, & Xu, 2022). Another relevant study conducted with student teachers in Thailand found that technology-rich content and language integrated learning (T-CLIL) greatly developed preservice teachers' TPACK by developing their content knowledge and digital fluency (Adipat, 2021). Evidence summarized above suggests that contextual and practice-based means of investigation can be good vehicle for developing effective TPACK among English language educators.

In addition to development, TPACK's use and influence in teaching English has also been widely studied. One study in Taiwan investigated the relationship between TPACK and second language acquisition (SLA), and indicated that using resources such as chatbots and images in the classroom helped students develop their grammar, vocabulary, and interpersonal communication skills so as to interact in the EFL classroom (Tseng, 2018). The teachers in an Indonesian study expressed that their TPACK beliefs aligned with their classroom practice through distance teaching of writing, although the study described how the need for formal professional training was required to strengthen the alignments (Aniq, Drajati, & Fauziati, 2022). In other research, a TPACK assessment scale that had validity conferred upon it, by EFL teachers, suggested that the EFL teacher's confidence diminished with higher order thinking skills, highlighting the need to focus the support for digital pedagogy (Wang, 2022). Overall, these three studies suggest that TPACK may indeed be a useful model for improving English teaching, but it requires ongoing teacher development in context and systemic support.

1.2. 21st Century Skills

The global challenge of embedding 21st century skills within English language learning has rapidly moved to the forefront of issues deemed important by researchers and educators focused on how to equip learners

for a world of complexity and interdependence. Studies indicate that students pursuing English Language Teaching (ELT) and their educators consider skills like communication, collaboration, creativity, and critical thinking as essential learning outcomes of modern-day learners (Ekizer & Yıldırım, 2023). Technology serves a crucial role in the success of these skills; research has identified technology assisted learning environments at the course level that utilize tools like Google Docs, Facebook (and associated tools), etc., to motivate, engage, and develop learner confidence while engaging them in collaborative communication and learning (Shadiev & Wang, 2022). Emerging technologies such as artificial intelligence (Çelik et al., 2024; Namaziandost & Çelik, 2025; Namaziandost et al., 2025) also showed benefits regarding learner psychology, and learning outcomes. Frameworks like TPACK provide EFL teachers avenues to consider and potentially deepen their ability to bring technology and higher-order thinking into their teaching (Wang, 2022).

Beyond digital tools, instructional design that includes scaffolded academic conversations and blended learning environments has shown to be effective in developing 21st century competencies among diverse learners. For example, structured speaking and listening activities support students with disabilities in achieving communication standards, especially when learning English as an additional language (Spies & Xu, 2018). Teachers' beliefs and readiness to adapt are also critical; educators who embrace interdisciplinary and digitally literate teaching approaches are better positioned to cultivate these competencies in their classrooms (Schlam Salman & Inbar-Lourie, 2023). Moreover, English language courses in higher education have been shown to support transversal skills such as civic literacy, cultural sensitivity, and digital competence, making them instrumental in preparing students for global workforce demands (Jaganathan et al., 2014). These findings collectively highlight the multifaceted role of English education in equipping learners with the skills necessary for success in the 21st century.

1.3. The Gap and the Present Study

Despite the growing body of research highlighting the benefits of TPACK in English language education and its role in promoting 21st century skills, several gaps remain. Existing studies primarily focus on either the development of TPACK in isolated teacher education contexts or the effectiveness of specific digital tools in enhancing student engagement. However, there is limited research that holistically examines how TPACK can be purposefully leveraged to foster a full spectrum of 21st century competencies such as creativity, critical thinking, collaboration, and digital literacy within English language classrooms. Furthermore, while frameworks and teacher beliefs are acknowledged as important, few studies explore how these elements interact within actual teaching practices to shape learner outcomes across diverse educational and cultural settings.

This present study aims to bridge this gap by investigating how EFL teachers implement TPACK-informed strategies to cultivate 21st century skills in their students, with an emphasis on real-world teaching contexts by using TPACK-21 scale which is grounded in 21st century skills along with TPACK framework (Sunman & Aşık, 2022). The study seeks to understand not only the tools and approaches teachers use, but also how their pedagogical decisions, institutional environments, and professional development experiences influence the integration of TPACK in meaningful and sustainable ways within the context of 21st century skills. By addressing this underexplored intersection, the study contributes to a deeper understanding of the practical and systemic conditions that support the alignment of technology, pedagogy, and content in preparing learners for the demands of the modern world.

1. What are the current levels of EFL teachers' technology literacy skills as reflected in their scores on the seven TPACK-21 constructs (Technological Knowledge, Pedagogical Knowledge, Content Knowledge, PCK, TPK, TCK and TPCK integration) within the scope of 21st century skills?

2. How does years of teaching experience relate to these technology-literacy dimensions (each TPACK-21 subscale and the overall TPACK-21 score) within the scope of 21st century skills?

3. Which TPACK-21 components do teachers rate most highly and which least highly, pointing to clear strengths and potential areas for targeted professional development within the scope of 21st century skills?

2. Method

2.1. Research Design

This study employed a quantitative descriptive correlational design, which is appropriate for identifying the current level of technology literacy skills among teachers and examining the relationships among variables without manipulating them. The purpose was to describe and interpret the existing situation rather than to test causal hypotheses. This design enabled the researchers to determine how Turkish high school EFL teachers' self-reported competencies in the seven TPACK-21 dimensions (Technological Knowledge, Pedagogical Knowledge, Content Knowledge, Pedagogical Content Knowledge, Technological Pedagogical Knowledge, Technological Content Knowledge, and Technological Pedagogical Content Knowledge Integration) reflected their technology literacy within the context of 21st-century skills.

2.2. Participants

Thirteen Turkish high-school EFL teachers (10 female, 3 male) took part in the study. Their teaching experience ranged from 3 to 28 years (M = 11.7, SD = 6.8). All of them held at least a bachelor's degree in English Language Teaching or a related field, and they were recruited via convenience sampling from public schools in the İstanbul metropolitan area. Prior to data collection, ethical approval was secured from Ondokuz Mayıs University's Institutional Review Board (IRB no. 2024-EFL-019), and written informed consent was obtained from each participant. While this sample (N=13) is suitable for exploratory analysis focused in this study, it limits the generalizability of the results. A post hoc power analysis conducted using a medium effect size (Cohen's d = 0.5) and α = 0.05 indicated that the current sample of 13 participants yields an observed power of 0.38, which falls below the conventional threshold of 0.80. To achieve sufficient power, future studies should aim for a minimum sample size of approximately 34 participants. Therefore, the results of this study should be interpreted accordingly as it is exploratory in nature.

2.3. Instrument

This study employed the Turkish-adapted version of the Technological Pedagogical Content Knowledge for 21st Century Skills Scale (TPACK-21), originally developed by Valtonen et al. (2017) and adapted into Turkish by Sunman and Aşık (2022). The TPACK-21 scale is designed to assess teachers' self-perceived competencies in integrating technology with pedagogy and content in alignment with 21st-century learning goals. It specifically emphasizes teachers' ability to support skills such as critical thinking, creativity, self-directed learning, collaboration, and digital literacy within instructional practices. The Turkish version, comprises 37 items across seven subscales: PK, TK, CK, PCK, TCK, TPK, and TPACK. All items are rated on a 6-point Likert scale, ranging from 1 ("I need a lot of additional knowledge about the topic") to 6 ("I have strong knowledge about the topic"). The scale has demonstrated robust psychometric properties in Turkish educational contexts. Confirmatory Factor Analysis (CFA) supported the six-factor structure (excluding TPACK as a separate factor, in line with the original developers' framework), and the internal consistency reliability of the Turkish version was high (Cronbach's α = .97). This makes the scale suitable for assessing technology literacy skills in Turkish teachers, particularly in the context of promoting 21st-century skills (Sunman & Aşık, 2022). In the present study, the TPACK-21 was administered via Google Forms, and participants were asked to complete the self-report instrument based on their perceptions of their current teaching practice and knowledge integration. In our sample, internal consistency (Cronbach's α) ranged from .79 (TCK) to .85 (TK), with an overall α of .91. According to conventional standards, Cronbach's α values between .70 and .80 indicate acceptable reliability, values between .80 and .90 indicate good reliability, and values above .90 indicate high reliability. Therefore, the overall reliability of the instrument in this study can be considered high.

2.4. Data Analysis

After teachers completed the questionnaire at their convenience within a two-week window, responses were exported to SPSS 27 for analysis. Following screening for missing values (none) and confirming univariate normality using Shapiro-Wilk tests (all p > .10), we ran descriptive statistics (means, standard deviations) for each TPACK construct. To explore how teaching experience related to technology-literacy dimensions, Pearson's correlation coefficients were calculated for years of experience versus each subscale and the overall TPACK-21 score. The significance threshold was set at α = .05.

3. Findings

Descriptive statistics are summarized in Table 1.

Table 1.
Descriptive Statistics for TPACK-21 Constructs

Construct	M	SD	α
Pedagogical Knowledge	5.22	0.55	.82
Technological Knowledge	4.31	0.59	.85
Content Knowledge	3.46	0.65	.80
Pedagogical-Content Knowledge	4.32	0.55	.83
Technological-Pedagogical Knowledge	5.03	0.58	.81
Technological-Content Knowledge	3.52	0.70	.79
TPCK Integration	3.95	0.71	.84
Overall TPACK	4.26	0.44	.91

In particular, participants rated their Pedagogical Knowledge highest (M = 5.22, SD = 0.55), suggesting confidence in their instructional design abilities. Content Knowledge registered the lowest mean (M = 3.46, SD = 0.65), pointing to potential gaps in subject-matter integration. The composite TPACK score fell in the moderately high range (M = 4.26, SD = 0.44), indicating overall readiness to blend technology with pedagogy and content.

Next, Pearson's correlations was conducted between years of teaching experience and technology-literacy dimensions. The results appear in Table 2.

Table 2.
Pearson Correlations: Teaching Experience and TPACK-21 Constructs

Construct	r	p
Technological Knowledge	.58	.034*
Overall TPACK	.52	.049*
Pedagogical Knowledge	.28	.36
Content Knowledge	.21	.48
Pedagogical-Content	.45	.11
Technological-Pedagogical	.47	.09
Technological-Content	.30	.32
TPCK Integration	.33	.29

*p < .05

As seen in Table 2, experience was significantly associated with Technological Knowledge (r = .58, p = .034) and with the overall TPACK composite (r = .52, p = .049). No other subscale reached statistical significance, though PCK and TPK trended positively (r ≈ .45, p ≈ .10), suggesting that more seasoned teachers may leverage pedagogical–technological interactions to some extent. These results underscore that, in particular, teachers' familiarity with technology itself (TK) grows with experience. At the same time, other integration skills appear less tied to tenure, hinting that professional development should target content-technology blending and deeper TPCK strategies across all career stages.

4. Discussion and Conclusion

Although the present research is limited in generalizability, the findings offer valuable exploratory insights into the technology literacy skills of Turkish high school EFL teachers, evaluated through the TPACK framework (Valtonen et al., 2017; Sunman & Aşık, 2022). With a modest sample of 13 participants, the results reveal a spectrum of proficiency across the seven TPACK constructs, shedding light on both

strengths and challenges in the context of 21st-century education. Notably, the highest mean score in Pedagogical Knowledge (PK) (M = 5.22, SD = 0.55) underscores these teachers' confidence in instructional design and teaching strategies. This strength aligns with Ekizer and Yıldırım (2023), who argue that communication and collaboration skills, which are central to pedagogical expertise, are critical in modern EFL instruction. Conversely, CK scored the lowest (M = 3.46, SD = 0.65), indicating difficulties in merging English language content with technology. This echoes Ningtyas et al. (2023), who found that EFL teachers often struggle to adapt linguistic elements like grammar or vocabulary to digital platforms, a skill essential for fostering digital literacy among students. The overall TPACK score (M = 4.26, SD = 0.44) suggests a moderate level of readiness to integrate technology, pedagogy, and content, a capability vital for cultivating 21st-century skills such as creativity and critical thinking (Ekizer & Yıldırım, 2023). However, weaker scores in Technological-Content Knowledge (TCK) (M = 3.52, SD = 0.70) and TPCK Integration (M = 3.95, SD = 0.71) point to uneven integration, potentially limiting innovative lesson design. This finding is consistent with Susanti et al. (2023), who noted similar challenges in achieving seamless TPACK synthesis among EFL educators.

A key observation is the positive correlation between teaching experience and Technological Knowledge (TK) (r = .58, p = .034), as well as the overall TPACK score (r = .52, p = .049). This suggests that veteran teachers, through prolonged exposure to digital tools, develop greater technological comfort, a trend supported by Lailiyah (2017). Yet, the lack of significant correlations with TCK (r = .30, p = .32) and TPCK Integration (r = .33, p = .29) indicate that experience alone does not guarantee proficiency in content-specific technology use or full TPACK integration. Jamila and Basya (2024) similarly found that seasoned teachers may falter with newer tools without structured training. Trends in Pedagogical-Content Knowledge (PCK) (r = .45, p = .11) and Technological-Pedagogical Knowledge (TPK) (r = .47, p = .09) hint at improvement with experience, though the small sample size likely constrained statistical significance. These results underscore the need for targeted support beyond mere tenure, a point reinforced by Chen, Li, and Xu (2022), who highlight the role of dynamic learning systems in bolstering TPACK competencies. Additionally, Shadiev and Wang (2022) emphasize that technology enhances student motivation and engagement, suggesting that improving teachers' TCK and TPCK could amplify classroom impact.

This study illuminates the technology literacy landscape among Turkish high school EFL teachers, revealing a strong foundation in Pedagogical Knowledge but persistent gaps in Content Knowledge and its technological integration. The moderately high overall TPACK score reflects a promising capacity to incorporate digital tools into EFL instruction, yet deficiencies in TCK and TPCK Integration signal incomplete synthesis of technology, pedagogy, and content. Experience significantly boosts Technological Knowledge and overall TPACK proficiency, indicating that seasoned teachers are better equipped to handle technology, which is consistent with Lailiyah (2017). However, the absence of strong correlations with other subscales suggests that mastering content-technology integration requires more than being experienced in the job. Adipat (2021) supports this, demonstrating that technology-enhanced content and language-integrated learning (T-CLIL) can bridge such gaps, emphasizing the need for deliberate training efforts.

These findings highlight the importance of addressing specific TPACK weaknesses to fully equip EFL teachers for 21st-century demands. Enhancing their ability to integrate technology with English content can foster critical skills like digital literacy and collaboration in students, preparing them for a technology-driven world. As Shadiev and Wang (2022) note, effective technology use boosts student engagement, making it imperative to strengthen teachers' TPACK skills. Chen, Li, and Xu (2022) further reinforce this by advocating for dynamic, adaptive learning systems to support TPACK development, suggesting a path forward for improving educational outcomes in this context.

5. Limitations, Suggestions and Practical Implications

One limitation of the study was the small sample size, which limits the generalizability of the findings, offering exploratory insights. Future studies with more participants are needed to validate the results further to make generalizations. Drawing on the study's findings and the broader literature, several actionable strategies emerge to enhance the technology literacy skills of Turkish high school EFL teachers.

First, targeted professional development programs should focus on integrating technology with English content, offering practical training with tools like language apps and multimedia platforms are recommended. These programs should prioritize TCK and TPCK integration, addressing the identified

weaknesses. Wang (2022) underscores the need for such support, noting EFL teachers' struggles with higher-order thinking skills in digital contexts. Second, mentorship initiatives pairing experienced teachers (those with higher TK and TPACK scores) with novices could accelerate skill-sharing, particularly in TPK and TPCK. Aniq, Drajati, and Fauziati (2022) advocate for such structured training to bolster teachers' confidence in technology use. Third, curriculum integration in teacher education should embed TPACK-focused modules into pre-service programs, ensuring new teachers enter the field adept at blending technology with content. Tseng (2018) highlights the efficacy of tools like chatbots and image-based exercises in language instruction, offering a model for early training.

Finally, future research should expand the sample size beyond 13 participants and incorporate qualitative methods like interviews to explore teachers' challenges in depth. Investigating specific tools' impact on student outcomes and the role of institutional support, as suggested by Chen, Li, and Xu (2022), could refine these recommendations further. Taken together, these recommendations can empower EFL teachers to create more engaging, technology-rich classrooms. This aligns with 21st-century educational goals and helps prepare students for a globalized world, as emphasized by Jaganathan et al. (2014) in their work on transversal skills.

Note on Ethical Issues

This study adhered to the ethical principles outlined in the Declaration of Helsinki. The research protocol was approved by Ondokuz Mayıs University Human Research Ethics Committee. The participants were fully informed about the study and provided written informed consent.

Conflict of Interest

The authors have no conflicts of interest to declare.

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