KMANPUB | AI and Tech in Behavioral and Social Sciences Vol. 3 No. 4 (2025): 1-15

Article history:
Received 26 May 2025
Revised 05 August 2025
Accepted 24 August 2025
Initial Published 26 October 2025
Final Publication 01 October 2025

Bridging the TPACK Gap: AI Integration in Iranian EFL Context

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A r t i c l e I n f o

Article type:
Original Research

How to cite this article:
Khodadust, M. R., Khodadoust, A., Faramarzi Kohnehshahri, F., & Hashemi, S. (2025). Bridging the TPACK Gap: AI Integration in Iranian EFL Context. *AI and Tech in Behavioral and Social Sciences, 3*(4), 1-15.
https://doi.org/10.61838/kman.aitech.4091

A B S T R A C T

This mixed-methods study, grounded in the Technological Pedagogical Content Knowledge (TPACK) framework, explores Iranian EFL teachers' perceptions and experiences regarding AI integration in EFL context of Iran. Combining a systematic literature review with survey data from 25 teachers, the research reveals strong enthusiasm for AI's potential to enhance personalization, engagement, and efficiency. However, significant barriers impede effective implementation: ethical concerns regarding data privacy and bias, a critical need for pedagogical training aligning AI with language teaching goals, and marked disparities in access between well-resourced and underfunded institutions. Qualitative insights further emphasized demands for equitable tool access and strategies preserving essential human interaction, reframing AI as a scaffold rather than a replacement. The findings highlight a critical TPACK misalignment, where contextual constraints dominate. The study concludes that realizing AI's potential requires TPACK-aligned professional development, policy interventions bridging resource gaps, and collaborative frameworks balancing innovation with socio-emotional learning. Implications hold global relevance for similar educational contexts.

Keywords: *TPACK, AI in EFL, Teacher Perceptions, AI Ethics, Professional Development*

1. Introduction

Artificial Intelligence (AI) is transforming English as a Foreign Language (EFL) instruction by enabling personalized learning, automated feedback, and administrative efficiency (Chen et al., 2022). Technologies like intelligent tutoring systems and adaptive platforms analyze student data to inform teaching strategies (Abatan et al., 2024; Biu et al., 2024), while automating tasks such as grading to free educators for direct student engagement (Falaiye et al., 2024; Ogunjobi et al., 2023). These core functionalities—personalization, automated feedback, and administrative support—represent the primary features of AI currently impacting EFL instruction, forming a key focus of this study.

Beyond core features, AI integration offers significant opportunities to enhance specific language skills and to address diverse learner needs through innovative methods. AI enhances specific language skills (e.g., reading comprehension (Xu et al., 2019); pronunciation (Noviyanti, 2020); conversational practice via tools like voice assistants (Dizon & Tang, 2020), and intelligent tutoring systems (Pokrivčáková, 2019). Mobile devices further amplify these benefits through portable AI applications (Luo & Cheng, 2020; Ma, 2020), expanding learning access and flexibility (Opportunity). However, realizing these opportunities

requires careful implementation, as overreliance on tools like machine translation may impede writing autonomy (Schmidt & Strasser, 2022), highlighting the need for pedagogical guidance within frameworks like TPACK."

Empirical evidence underscores AI's opportunity to positively impact learner achievement contributing to learning success (Xu et al., 2023), improving vocabulary knowledge (Hsu et al., 2024), and enhancing speaking proficiency (Junaidi, 2020). Nevertheless, realizing AI's full potential faces challenges, including unresolved ethical concerns and a critical need for teacher training (RQ3, RQ4). This training gap underscores the essential Pedagogical Knowledge (PK) component within TPACK required for effective integration.

However, integrating AI into teaching poses significant challenges. While AI presents clear opportunities for personalization and potentially reducing educational disparities through tailored resources (de Oliveira Silva & dos Santos Janes, 2022; Popescu, 2023), its rapid adoption simultaneously raises significant challenges and ethical concerns. These include inherent risks of algorithmic bias, data privacy violations, and the potential diminishment of crucial human interaction in learning (Kolog et al., 2022). Navigating this dual nature—leveraging opportunities while mitigating challenges—requires a nuanced understanding best provided by frameworks like TPACK, which explicitly addresses the intersections of technology, pedagogy, content, and context. This study employs the Technological Pedagogical Content Knowledge (TPACK) framework (Mishra & Koehler, 2006) to examine how EFL teachers conceptualize the potential of AI tools (TK), translate this potential into effective pedagogical practices (PK), manage ethical and content-specific challenges (CK), and navigate contextual barriers when integrating AI into Iranian EFL instruction.

The ethical implications of AI in education constitute a primary barrier. Studies have revealed biases in AI algorithms that may inadvertently perpetuate inequalities if not managed properly (Kolog et al., 2022). Furthermore, as AI tools automate certain teaching responsibilities, educators express apprehension about the potential erosion of student-teacher interactions and stress the importance of maintaining the human element in education (Vuong et al., 2023). Striking an ethical balance where AI enhances rather than replaces traditional methodologies is paramount, demanding careful consideration within the Content Knowledge (CK) and Pedagogical Knowledge (PK) domains of TPACK.

A significant opportunity lies in AI's capacity to enhance teaching effectiveness by streamlining administrative tasks, enabling educators to devote more time to direct student engagement and instructional quality (Akinwalere & Ivanov, 2022). However, successful implementation hinges on comprehensive educator training encompassing not only technical skills but also ethical usage considerations (Challenge). This necessity underscores the core premise of TPACK: effective technology integration requires the interconnected development of Technological Knowledge (TK), Pedagogical Knowledge (PK), and Content Knowledge (CK). TPACK provides a critical lens to examine how EFL teachers:

(a) Conceptualize AI's role in scaffolding language acquisition (TK-PK synergy)

(b) Negotiate ethical tensions when automating assessments (TK-CK dilemmas)

(c) Develop context-responsive strategies for equitable implementation (contextual domain)

Given AI's documented capacity for personalization yet unresolved ethical tensions in EFL contexts (Kolog et al., 2022), this study explores the features, opportunities, and challenges associated with AI in EFL classrooms. Focusing on Iran—a context with centralized curricula but stark resource disparities between urban/rural schools—this study examines how sociocultural and institutional factors shape AI adoption. We interrogate whether AI's purported benefits withstand contextual realities like resource constraints and ethical trade-offs. In particular, the following research questions have been formulated:

1. How do Iranian EFL teachers perceive the pedagogical opportunities and implementation challenges of AI tools?
2. How do institutional resource disparities... and teachers' professional characteristics (e.g., years of experience, educational qualifications, prior technology training) shape AI adoption?
3. What ethical tensions arise in AI-integrated EFL instruction, particularly regarding data privacy, algorithmic bias, and the preservation of human interaction?
4. How does the TPACK framework explain misalignments in teachers' readiness to ethically and pedagogically integrate AI?

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1.1. *AI-mediated Opportunities in EFL Education*

AI technologies enable EFL teachers to create tailored learning pathways that address individual student needs (Dai & Liu, 2024). By analyzing performance data, AI tools adapt content difficulty and pacing—reported by 88% of surveyed teachers as enhancing engagement. This personalization fosters learner autonomy while allowing educators to target specific skill gaps (Umar, 2024). Technical barriers disproportionately affect under-resourced learners, potentially amplifying inequities (Dai & Liu, 2024). Notably, 68% of teachers highlighted access gaps—a systemic challenge eclipsing individual tool limitations.

Real-time feedback systems (e.g., speech recognition, virtual tutors) significantly improve speaking proficiency by providing immediate pronunciation correction and conversational practice (Sari, 2023). These tools reduce learner anxiety through low-stakes interaction, with 72% of teachers noting increased student participation in oral activities.

Adaptive learning platforms adjust to learners' needs, balancing challenge levels to sustain engagement. This ensures continuous skill progression across diverse proficiency levels while freeing teachers from routine tasks—80% reported more time for individualized support (Biu et al., 2024).

1.2. *Challenges Associated with Using AI*

While Artificial Intelligence holds significant promise for transforming English as a Foreign Language (EFL) instruction, its effective implementation presents a complex array of challenges that educators and learners must collaboratively address. Foremost among these are interconnected technical and pedagogical hurdles. Students frequently encounter difficulties accessing or effectively utilizing AI tools, stemming from issues like unreliable connectivity, platform complexity, or inadequate digital literacy (Dai & Liu, 2024). These accessibility barriers can significantly impede engagement and learning efficacy. Compounding these difficulties, educators express a legitimate pedagogical concern: that overreliance on AI might inadvertently undermine the development of students' independent learning strategies and critical thinking capacities, posing a fundamental tension between leveraging technological assistance and preserving essential language skill development.

Beyond technical access, profound ethical considerations demand rigorous attention. The very nature of AI in education, reliant on collecting and analyzing student data for functionality, introduces critical risks related to data privacy and security (Umar, 2024). Ensuring this sensitive information is protected against misuse or exposure is paramount for maintaining trust. Equally concerning is the potential for algorithmic bias embedded within AI systems, which risks perpetuating or even exacerbating existing educational inequities by disadvantaging specific learner demographics. Addressing these ethical dimensions—privacy, bias, and resultant equity concerns—is not optional but essential for cultivating a trustworthy and fair learning environment where AI's benefits are accessible to all.

Further complicating integration are inherent limitations within specific AI applications commonly used in language learning. Tools powered by Natural Language Processing (NLP), such as chatbots, while demonstrably effective for structured practice in areas like grammar and vocabulary acquisition (Gutiérrez, 2023), often struggle with the nuanced comprehension, contextual understanding, and cultural sensitivity required for authentic human communication. Misinterpretations of sarcasm, idiomatic expressions, or subtle contextual cues are common, presenting significant obstacles in a discipline where precise comprehension and expressive accuracy are foundational. Consequently, to effectively mitigate these NLP limitations and maximize tool utility, educators require targeted training in troubleshooting and contextual application—a critical need explicitly highlighted by 80% of participating teachers in this study.

Ultimately, these multifaceted challenges converge on a fundamental requirement: comprehensive preparation. Bridging the gap between AI's potential and its effective classroom realization necessitates robust support systems for both educators and learners (Lampou, 2023). Educators urgently require sustained professional development that integrates three crucial strands: technical proficiency with AI tools, deep understanding of ethical implications and mitigation strategies, and pedagogical expertise for seamlessly embedding AI into language instruction. Simultaneously, students must develop enhanced digital literacy skills to navigate and interact productively with these technologies. Without this dual-pronged investment in readiness, the transformative potential of AI in EFL risks remaining unrealized, overshadowed by avoidable implementation difficulties and unmet expectations.

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1.3. Ethical Imperatives and Forward Pathways for AI in EFL

The accelerating integration of Artificial Intelligence (AI) into educational landscapes necessitates urgent and sustained attention to its ethical dimensions. As AI adoption progresses, complex questions emerge regarding its potential impacts on equity, fairness, and the fundamental values of the learning environment. Scholars emphasize a critical research gap concerning ethics, fairness, and bias within educational AI applications, underscoring how these factors can profoundly influence student experiences and outcomes (Gašević et al., 2023). A central imperative is investigating pathways through which AI systems might inadvertently perpetuate existing societal inequalities or generate novel forms of bias within pedagogical settings.

Addressing these multifaceted ethical challenges demands a concerted, multi-stakeholder effort. Effective solutions cannot emerge in isolation but require proactive collaboration among educators, policymakers, researchers, and technology developers (Barnes & Hutson, 2024). However, open-ended responses also revealed teachers' sense of limited individual agency in managing systemic ethical risks like data privacy protocols or algorithmic bias audits. Participants frequently framed these as responsibilities requiring institutional or policy-level intervention (e.g., schools need secure systems, government must check tools for fairness), suggesting that while PK development can raise awareness, resolving core ethical challenges demands action beyond the classroom level. Such partnerships are foundational for establishing equitable AI frameworks grounded in principles of transparency, accountability, and inclusivity (Leta & Vancea, 2023). Through collective action, stakeholders can develop robust guidelines and standards aimed at ensuring fair access to AI benefits and equitable treatment for every learner. This collaborative governance is vital for mitigating algorithmic bias risks and fostering AI systems that genuinely empower, rather than marginalize, student populations (Cachat-Rosset & Klarsfeld, 2023; Fukuda-Parr & Gibbons, 2021).

Looking ahead, advancing both the ethical and pedagogical efficacy of AI requires dedicated research. Promising avenues include exploring AI-driven dynamic assessment methodologies (Onesi-Ozigagun et al., 2024). These approaches offer the potential for real-time analysis of student performance, enabling educators to deliver highly responsive, individualized instruction tailored to evolving learner needs. This capacity for adaptability promises significantly enhanced personalization, potentially boosting engagement and achievement. Furthermore, shifting towards continuous, AI-facilitated feedback represents a move away from reliance on high-stakes testing, aligning more closely with progressive educational philosophies centered on student growth. Such integrated assessment systems can cultivate supportive learning climates where students feel encouraged to experiment, learn constructively from errors, and develop language proficiency alongside a resilient growth mindset. Therefore, the future vitality of AI in education hinges on maintaining dual priorities: rigorous ethical scrutiny and continuous research into pedagogical innovation.

2. Methods and Materials

2.1. Participants

The study surveyed 25 Iranian EFL teachers from public/private high schools across diverse socioeconomic regions, reflecting the nation's urban-rural educational dispersion. Teachers were recruited from diverse Iranian contexts—urban, semi-urban, and rural schools—to capture socioeconomic variations. Table 1 presents demographic information about the participants:

Table 1

Demographic Information of Participants

Characteristic	Subcategory	Count	Proportion
Age Group	24-29 years	10	40%
	30-34 years	6	24%
	35-39 years	3	12%
	40-44 years	6	24%
Gender	Male	10	40%
	Female	15	60%
Highest Degree	Bachelor's Degree	10	40%

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	Master's Degree	14	56%
	Doctorate	1	4%
Experience	2-5 years	8	32%
	6-10 years	9	36%
	11-15 years	5	20%
	16-20 years	3	12%
School Type	Public School	18	72%
	Private School	7	28%

The purposive sample of 25 Iranian EFL teachers aligns with qualitative exploratory research objectives, prioritizing in-depth thematic analysis of open-ended responses over statistical generalizability (Baker & Edwards, 2012). Given the homogeneity of Iran's national EFL curriculum and the study's focus on teacher perceptions rather than student outcomes, this sample size achieved data saturation—confirmed by the absence of new themes in later interviews (Guest et al., 2006). As detailed in Table 1, participants represented diverse professional backgrounds: predominantly early-career educators (40% aged 24-29 years), with balanced gender representation (60% female, 40% male), advanced qualifications (56% holding Master's degrees), varied teaching experience (36% with 6-10 years), and primarily public-school employment (72%).

2.2. Instruments

This study employed a mixed-methods approach, strategically integrating library-based research with a researcher-designed survey to comprehensively explore AI integration within Iran's EFL context. This dual-method design allowed for triangulation, enriching the analysis through complementary data sources.

The library-based component constituted a systematic review of scholarly literature to establish foundational understanding and contextualize findings. Relevant sources were rigorously identified from academic databases (Scopus, Web of Science, ERIC), specialized books on AI in education and educational technology, government policy documents, and research papers from technology organizations. This comprehensive synthesis provided the theoretical framework and identified key themes—features, opportunities, challenges, and ethical considerations—guiding the subsequent empirical investigation.

Complementing this, the primary empirical instrument was the 'Iranian EFL Teachers' AI Integration Survey' (IEFAIS), a structured questionnaire specifically developed to capture the lived experiences and perceptions of EFL educators. The IEFAIS comprised two core sections:

Section A (Demographics) collected essential background information: gender, age group (e.g., Under 25, 25-34), teaching experience bracket (e.g., 1-5 years, 6-10 years), highest educational qualification, and current teaching level. This data enabled crucial demographic analysis of response patterns.

Section B (AI Perceptions and Experiences) contained 16 Likert-scale items probing multifaceted aspects of AI integration. Key constructs assessed included: satisfaction with available AI tools; perceptions of AI's role in educational equity; concerns regarding data privacy and algorithmic bias; views on the accuracy and fairness of AI assessments; opinions on AI's potential for personalizing learning; perceived ethical implications; self-reported impact of AI on teaching efficacy; and self-rated proficiency with AI technologies. Furthermore, to capture nuanced insights beyond scaled responses, a concluding open-ended item explicitly invited teachers to elaborate on the features, challenges, and opportunities they associated with AI in EFL instruction.

While the Likert items assessed broad constructs (e.g., satisfaction, perceived benefits, concerns), the open-ended item (Item 17) specifically invited teachers to name which AI tools they used or were aware of (e.g., ChatGPT, grammar checkers, pronunciation apps, adaptive platforms) and describe their specific experiences with them.

Recognizing the critical importance of instrument rigor, a multi-stage validation process was meticulously undertaken prior to deployment. The initial IEFAIS draft was grounded in a thorough review of literature concerning AI in EFL contexts. To enhance face validity and clarity, a pilot study was conducted with 10 Iranian EFL educators distinct from the main sample. Their feedback on question comprehension, response option suitability, and overall structure informed significant refinements to phrasing and format.

Content validity was rigorously assessed using the Content Validity Index (CVI). Subject matter experts, including university professors and seasoned EFL practitioners, evaluated each item's relevance on a 4-point

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scale (1 = Not relevant, 4 = Highly relevant). Achieving a strong CVI score of 0.85 demonstrated high expert consensus on the instrument's relevance to the study's core objectives. Finally, reliability was established via Cronbach's alpha coefficient, which yielded an excellent score of $\alpha = 0.92$, confirming high internal consistency across the Likert-scale items. This comprehensive validation process ensured the IEFAIS was both a psychometrically sound and contextually relevant tool for investigating Iranian EFL teachers' perspectives on AI integration.

2.3. *Procedure*

The data collection protocol was meticulously designed to uphold methodological rigor and ethical standards. Following institutional approval, potential participants received comprehensive study information detailing the research purpose, voluntary nature of participation, and robust measures guaranteeing anonymity. Written informed consent was secured from all 25 participating teachers prior to engagement.

To maximize accessibility and accommodate diverse contexts across Iranian public (72%) and private (28%) schools, the validated IEFAIS questionnaire was deployed through dual modalities:

1. Digital Distribution: Electronically disseminated via email with secure submission links.
2. In-Person Administration: Physical copies were provided during scheduled school visits, particularly facilitating participation in areas with limited connectivity.

Upon retrieval, all questionnaires underwent: a. Completeness Screening: Responses were systematically reviewed. Partially completed instruments were excluded from primary analysis to maintain data integrity. b. Clarity Assurance: Participants indicating difficulties during completion were offered clarification support to ensure accurate interpretation of items, thereby minimizing response bias. This step proved particularly valuable for complex items addressing AI ethics and pedagogical integration.

Finally, the curated dataset proceeded to analysis, with quantitative responses prepared for statistical processing in SPSS v28 and qualitative open-ended responses undergoing thematic coding per (Braun & Clarke, 2006)'s framework.

2.4. *Data Analysis*

Data analysis employed a mixed-methods approach, rigorously integrating quantitative and qualitative techniques to comprehensively address the research questions.

Descriptive statistics (frequencies, percentages) characterized participant demographics and summarized responses to the 16 Likert-scale items, providing an overview of AI perceptions and experiences. To examine associations between demographic variables (e.g., years of experience, institution type, education level) and AI-related attitudes/behaviors, inferential analyses were conducted. Given the ordinal/categorical nature of the data and the modest sample size (n = 25), non-parametric tests were appropriately selected:

1. Spearman's rank-order correlations assessed potential relationships between teaching experience and perceived AI benefits/challenges.
2. Chi-square tests (supplemented by Fisher's exact test where cell counts were <./05) explored links between institution type (public/private) and AI adoption frequency/concerns.
3. Kruskal-Wallis H tests compared differences in AI attitudes across distinct age groups and educational attainment levels.
4. All analyses utilized SPSS v28, with statistical significance set at $p < .05$.

Moreover, responses to the open-ended item (Item 17) underwent systematic thematic analysis following (Braun & Clarke, 2006)'s six-phase framework. This involved (1) repeated reading of responses for familiarization; (2) generating initial descriptive codes capturing specific tool mentions, perceived impacts, and concerns; (3) collating codes into potential themes (e.g., Chatbots for Speaking Practice, Gamification for Grammar); (4) reviewing themes against the coded data and entire dataset; (5) defining and naming final themes (Table 7); (6) producing the analysis report.

To achieve a nuanced understanding, findings from the quantitative statistical analyses and the qualitative thematic analysis were triangulated and comparatively examined. This integration provided a richer, more comprehensive insight into Iranian EFL teachers' lived experiences and multifaceted perceptions regarding AI integration in their pedagogical practices.

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3. Findings and Results

3.1. Library Study Synthesis

Systematic analysis of scholarly literature, policy documents, and technical reports revealed core dimensions of AI integration in EFL contexts, categorized in Table 2. The evidence demonstrates AI's capacity to simulate human cognition—enabling adaptive tutoring systems responsive to individual learning trajectories (Abatan et al., 2024)—and transform assessment through automated feedback mechanisms (Biu et al., 2024). Natural language processing capabilities further facilitate conversational practice (Dizon & Tang, 2020), while mobile integration extends learning beyond traditional classrooms (Luo & Cheng, 2020). These functionalities collectively establish AI's potential as a dynamic facilitator of language acquisition.

Table 2

Library-based Study Results

Category	Description	Source
Main Features of AI	Mimics cognitive functions associated with human thinking, including learning and problem-solving.	Russell & Norvig, as referenced by (Chen et al., 2020)
	Intelligent tutoring systems that adapt to individual learning needs.	(Abatan et al., 2024)
	AI technologies for automatic grading and providing feedback.	(Biu et al., 2024)
	Natural language processing capabilities to facilitate interactive learning experiences.	(Dizon & Tang, 2020)
	Integration with mobile devices enhancing language teaching tools.	(Luo & Cheng, 2020)
Opportunities	Personalizes learning experiences to cater to individual student needs.	(Popescu, 2023); (Alharbi, 2024)
	Enhances student engagement and motivation through interactive platforms like ChatGPT.	(de Oliveira Silva & dos Santos Janes, 2022)
	Provides tailored resources that address educational inequalities.	(Fitria, 2021)
	Improves language skill development, including reading comprehension and pronunciation.	(Xu et al., 2019); (Noviyanti, 2020)
	Allows for the automation of administrative tasks, freeing up time for teachers to engage with students.	(Falaiye et al., 2024); (Ogunjobi et al., 2023)
Challenges	Ethical concerns including bias in AI algorithms that may affect instructional fairness.	(Kolog et al., 2022)
	Dependence on technology that potentially hampers the development of independent learning skills.	(Schmidt & Strasser, 2022)
	Need for adequate teacher training and support to effectively integrate AI into classrooms.	(Popescu, 2023)
	Limited access to the necessary technology, particularly in under-resourced schools.	(Alharbi, 2024)
Ethical Considerations	Issues related to data privacy and security involved with the collection and use of student data.	(Kolog et al., 2022)
	Concerns about the erosion of human interaction in learning environments due to increased reliance on AI.	(Kolog et al., 2022)
	Potential for AI to promote educational inequalities if not implemented equitably.	(Alharbi, 2024)

As shown in Table 2, The documented opportunities, however, intersect with significant implementation challenges. While AI enables personalized learning pathways (Popescu, 2023), its effectiveness is moderated by ethical risks including algorithmic bias that may reinforce educational inequities. Furthermore, technology dependency raises concerns about diminished learner autonomy (Schmidt & Strasser, 2022), and equitable access remains problematic across resource-variable environments. Crucially, these challenges foreground three ethical imperatives: rigorous data protection protocols, preservation of human-centered pedagogy, and policy frameworks ensuring inclusive implementation to prevent exacerbating existing disparities.

3.2. Survey Results: Teacher Perspectives

Empirical data from Iranian EFL educators reveal distinct patterns in AI adoption and perceptions, summarized in Table 3. High endorsement of AI's pedagogical value is evident, with 88% recognizing its personalization capabilities and 92% expressing overall optimism. However, significant implementation barriers persist: 80% report inadequate training, while 68%

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highlight resource-related access limitations, particularly in public institutions.

Table 3

Responses to Questionnaire Items on AI Integration in EFL Instruction

Main Categories	Questionnaire Items	Frequency (N)	Percentage (%)
Perceived Benefits of AI	Improved engagement in language learning	20	80%
	Personalized learning experiences	22	88%
	Enhanced assessment and feedback	18	72%
	Flexible learning opportunities	21	84%
Implementation in the Classroom	Need for teacher training and support	20	80%
	Limited access to AI tools in under-resourced environments	17	68%
Frequency of AI tool usage in teaching	Daily use	5	20%
	Weekly use	12	48%
	Monthly use	8	32%
Overall Attitude Towards AI	Positive attitudes towards AI's role in education	23	92%
	Concerns about the loss of human interaction	10	40%

Notably, a pronounced attitude-practice gap emerges—though 92% acknowledge AI's educational potential, only 20% incorporate it daily. Ethical reservations are widespread, with 60% concerned about data privacy and 40% apprehensive about reduced human interaction. These findings suggest contextual constraints significantly mediate technological adoption, with institutional resources and preparedness outweighing theoretical enthusiasm. Teachers' concerns regarding AI implementation, captured through a multiple-response question (Item 3), reveal ethical and practical challenges as shown in Table 4.

Table 4

Multiple Response Concerns about AI (Item 3)

Concern Type	Frequency	Percentage
Data privacy & security	15	60%
Bias in algorithms	12	48%
Lack of human interaction	10	40%

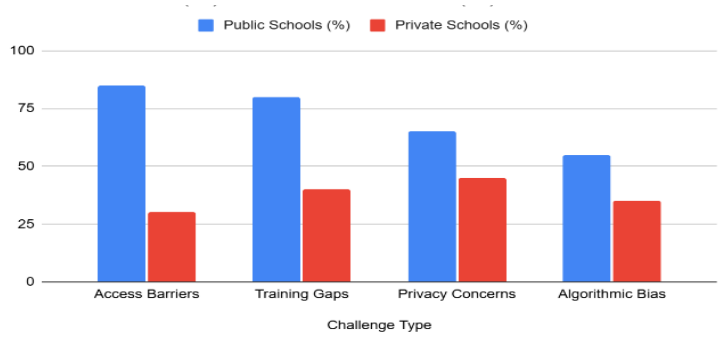
Note: Percentages exceed 100% as teachers selected multiple concerns.

As Table 3 and Table 4 show, quantitative and qualitative data converge on three tensions: high optimism (92%) versus limited daily use (20%), demand for personalization (88%) versus ethical hesitations (60%, Table 4), and AI's theoretical equity benefits versus its exclusionary realities

Figure 1 visualizes these disparities, showing how access gaps and training needs disproportionately affect public institutions.

Figure 1

Comparison of Key Barriers for Public School vs. Private School EFL Teachers in Iran



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E-ISSN: 3041-9433

Quantitative and qualitative data converge on three tensions: high optimism (92%) versus limited daily use (20%), demand for personalization (88%) versus ethical hesitations (60%), and AI's theoretical equity benefits versus its exclusionary realities in public schools (χ^2=4.2, p=.04).

The attitude toward AI appears overwhelmingly positive, with 92% of participants expressing supportive views about AI's role in education. Nevertheless, 40% expressed concerns regarding the potential loss of human interaction in the learning process, indicating a need for a balanced approach to technology integration. This data illustrates a dual sentiment surrounding AI in the classroom, where optimism for technological advancements exists alongside caution regarding their effects on traditional learning dynamics. Therefore, both the benefits and challenges of AI integration should be taken into account to maximize its effectiveness in EFL instruction. TPACK's technological knowledge domain surfaced in 88% of teachers endorsing AI for personalization, yet pedagogical knowledge gaps emerged as 80% requested training to align AI with communicative language teaching principles.

3.3. Inferential Analyses

Table 5 shows the results of inferential statistics.

Table 5

Inferential Statistical Results

Relationship Tested	Test Used	Statistic	p-value	Interpretation
Exp. years vs. AI optimism	Spearman's correlation	r < = -.42	.03	Significant negative correlation
Institution type vs. AI usage	Chi-square	$\chi^2(1) = 4.2$	.04	Public schools used AI significantly less frequently ($p<.05$)
Education level vs. bias concern	Kruskal-Wallis	H = 6.1	.047	Higher education → more concern

As shown in Table 5, following SPSS analysis of the data, significant correlations emerged:

1. Negative correlation between teaching experience and AI optimism (r_s = -.42, p= .03), suggesting less-experienced teachers favored AI more technological innovation.
2. Public-school teachers reported lower AI usage frequency than private-school peers (χ^2 (1) = 4.2, p= .04).
3. Higher education levels correlated with greater concern about bias (H (2) = 6.1, p = .047).

Moreover, the negative correlation between teaching experience and AI optimism (r_s = -.42, p=.03) reflects TPACK's emphasis on context: veteran teachers may prioritize pedagogical integrity over technological novelty. Table 4 summarizes the main TPACK findings.

The quantitative findings reveal distinct pressures on different TPACK domains. High value placed on personalization (88%, Table 3) underscores perceived Technological Knowledge (TK) benefits. However, the critical demand for training (80%, Table 3) and concerns about pedagogical impact (e.g., overreliance, Table 4) highlight a deficit in Pedagogical Knowledge (PK) for integrating TK effectively. Significant ethical concerns (60% data privacy, 48% bias, Table 4) point to tensions within Content Knowledge (CK), where AI's language processing limitations and data risks intersect with EFL's communicative and ethical demands. Crucially, the stark public-private disparity in usage (Table 5, χ^2=4.2, p=.04) exemplifies the dominant influence of the Contextual Knowledge domain, where infrastructural and resource constraints inhibit TK-PK-CK synthesis. These domain-specific pressures are summarized in Table 6.

Table 6

Key TPACK Connections

Finding	TPACK Component	Interpretation
88% value personalization	Technological Knowledge (TK)	AI as adaptive tool
80% demand training	Pedagogical Knowledge (PK)	Need for AI-pedagogy alignment
Privacy/bias concerns (60%)	Content Knowledge (CK)	Ethical language-specific implications

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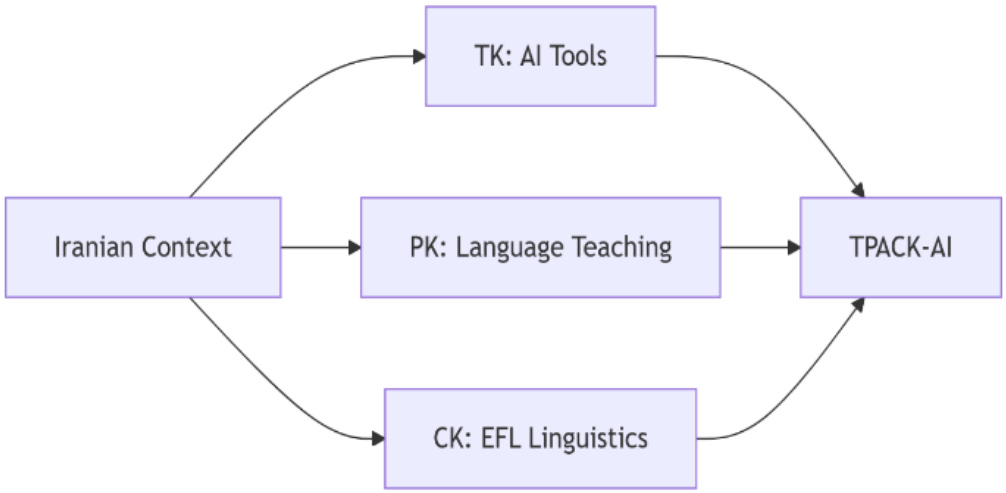
Public-private usage gap	Contextual Knowledge	Institutional resource disparities

The TPACK framework reveals critical misalignments in AI integration: while teachers recognize AI's Technological Knowledge benefits (88% value personalization), they lack Pedagogical Technology Knowledge to ethically leverage these tools—explaining urgent training demands (80%). Privacy and bias concerns (60%) reflect unaddressed Content Knowledge tensions, where AI's language-processing limitations clash with EFL's communicative goals. Most significantly, the public-private adoption gap (χ^2=4.2, p=.04) exposes Contextual Knowledge failures, as resource disparities prevent TPACK's core integration. Thus, AI's efficacy hinges not on technical features alone, but on systematically bridging technology, pedagogy, and context. Figure 2 models this integration, positioning contextual constraints (e.g., resource gaps) as critical to TPACK-aligned AI implementation.

Figure 2

TPACK Framework for AI Integration in EFL Contexts



3.4. Results for the Open-ended Item of the Questionnaire

Analysis of open-ended responses revealed not only thematic priorities but also identified specific types of AI tools mentioned by teachers. Commonly referenced tools included AI chatbots (e.g., ChatGPT, character.ai), automated grammar/vocabulary checkers (e.g., Grammarly), pronunciation feedback apps, and adaptive learning platforms. The priorities below reflect their experiences with these specific applications. The results are summarized in Table 7.

Table 7

Thematic Analysis of Open-Ended Responses

Focus Area	Key Priorities	Frequency	Specimen Insights
Pedagogical Innovation	Interactive Learning Tools	18	Gamified elements boost participation
	Conversation Practice Systems	15	Chatbots build speaking confidence
	Adaptive Content Design	20	Custom pathways for diverse learners
Professional Support	Skill-specific Scaffolding	12	Targeted materials for struggling students
	Implementation-focused PD	23	Hands-on training for classroom integration
Resource Equity	Universal Access Provisions	22	Bridge digital divides across regions
	Low-band width Solutions	14	Audio-based alternatives for limited devices
Ethical Governance	Data Protection Protocols	16	Secure handling of student information
	Algorithmic Transparancy	13	Bias audits during teacher training

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EFL teachers identified key priorities for AI integration through open-ended responses. Regarding pedagogical benefits, many highlighted AI's role in fostering student participation through conversational tools like chatbots, which provide low-stakes speaking practice. As one teacher noted, automated feedback during dialogue simulations helps build confidence before real interactions. Others mentioned adaptive gamification could increase motivation in grammar practice.

Personalization emerged as another critical area, with teachers advocating for AI systems that diagnose individual proficiency gaps and adjust content pacing accordingly. Multiple respondents suggested machine diagnostics could identify specific linguistic weaknesses, allowing customized remediation paths that traditional group instruction cannot provide. This connects closely to professional development needs, where participants emphasized practical workshops on ethical implementation rather than theoretical training. Several teachers stressed that technical support should focus on classroom-ready strategies to overcome implementation barriers.

Significant equity concerns surfaced around resource disparities, with recommendations for offline-compatible AI tools to serve connectivity-limited areas. One teacher proposed audio-based mobile applications as an alternative for device-limited students. Ethical imperatives were equally prominent, focusing on institutional accountability for data security and bias prevention. Participants urged mandatory algorithm audits and student/parent consent protocols before deploying AI systems, noting that transparency in data usage builds essential trust in educational technology.

3.5. Synthesizing Findings: Literature and Survey Perspectives on AI in EFL

This analysis integrates insights from the literature review (Table 2) with empirical survey data (Table 3), revealing both convergence and critical nuances regarding AI's role in EFL instruction.

A. Shared Recognition of Benefits: Both scholarly discourse and teacher perspectives strongly affirm AI's potential to enhance EFL learning. A dominant theme is personalization, with 88% of surveyed teachers endorsing AI's capacity for individualized learning pathways, mirroring literature claims about AI's adaptability. Similarly, the potential for increased student engagement resonates across sources: literature points to motivational gains from interactive platforms, while 80% of teachers identified this as a key advantage of AI integration.

B. Convergence on Key Challenges: Despite optimism, significant barriers to effective AI implementation are consistently highlighted. Ethical concerns, particularly data privacy, emerged as a major hurdle, explicitly raised by 60% of teachers and extensively discussed in the literature regarding sensitive student information handling. Furthermore, the critical need for teacher training and support was underscored by 80% of survey participants, directly aligning with scholarly emphasis on preparing educators as essential for successful technological adoption.

C. Divergence: Enthusiasm vs. Practice: While the literature broadly analyzes challenges like algorithmic bias and reduced human interaction, the survey provides concrete evidence of an implementation gap. Despite overwhelming theoretical support (92% of teachers acknowledged AI's positive role), actual daily usage remained low (only 20%). This stark contrast between positive attitudes and limited practical application underscores persistent real-world obstacles beyond mere awareness of potential. Furthermore, while literature often positions AI as a potential equalizer. the significant access gap observed between public and private schools directly challenges this assumption within the Iranian context, demonstrating how pre-existing structural inequities can be exacerbated rather than alleviated by technological introductions without targeted support.

D. Teacher Recommendations Amplifying Themes: Open-ended survey responses provided granular detail, reinforcing and extending themes identified in the combined analysis. Teachers prioritized continued professional development, emphasized the necessity for equitable access to AI tools, and stressed the urgency of addressing ethical implications. Specific calls for engaging interactive elements and tailored resources further highlighted the demand for solutions that bridge the gap between AI's promise and practical

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classroom integration. These insights demonstrate educators' sophisticated understanding of the complexities involved and reinforce the imperative for balanced, strategic approaches to AI adoption in EFL contexts.

4. Discussion and Conclusion

Iranian EFL teachers largely recognize AI's technological benefits (e.g., automated feedback), yet most lack the pedagogical expertise to implement it ethically—explaining the urgent demand for training (80%). This gap prevents AI from realizing its potential in scaffolding sociocultural language learning (Vygotsky, 1978), often relegating it to drill-and-practice rather than fostering authentic interaction. Within Iran's centralized system, stark disparities emerged: teachers in under-resourced public schools (72% of participants) reported significantly lower AI adoption than private counterparts directly challenging literature framing AI as an inherent. This exposes how structural inequities, not pedagogical value, dictate AI's impact. Cultural emphasis on teacher authority further contextualizes concerns about diminished human interaction (40%).

This resource gap exemplifies TPACK's contextual domain, where material constraints impede TK-PK synthesis. Resolution requires TPACK-aligned professional development positioning AI as a scaffold for—not replacement of—humanistic pedagogy.

Notably, early-career teachers showed greater AI optimism. While greater technological familiarity likely contributes, this may also reflect less entrenched pedagogical practices, exposure to newer teacher training curricula incorporating technology, or institutional expectations placed on newer staff to utilize emerging tools; these concerns validate warnings about AI ethics (Kolog et al., 2022), positioning trust deficits—not technical barriers—as primary adoption hurdles.

Crucially, teachers reconceptualized AI as a bridge to human interaction, not its substitute. They championed chatbots for low-stakes speaking practice (reducing anxiety,72%) and AI analytics to enhance personalized feedback—supporting its role in preparing learners for authentic dialogue (Sari, 2023). Teacher suggestions from open-ended responses reinforced this scaffolding role, proposing concrete applications like using chatbots for preparatory speaking drills or vocabulary practice outside class time, thereby freeing valuable face-to-face interaction for higher-order communicative activities, personalized feedback, and socio-emotional support that AI cannot replicate. This reflects a nuanced understanding of leveraging TK to enhance, not replace, core PK and CK goals centered on human connection.

The findings underscore a dual imperative for professional development: equipping educators with both technical skills and ethical understanding. Participants prioritized practical, implementation-focused workshops, aligning with calls for targeted training (Popescu, 2023). While AI can alleviate administrative burdens (endorsed by 80% for automating assessment), realizing this hinges on institutional support. Collaborative frameworks involving policymakers and developers are essential to build supportive infrastructure.

Open-ended responses reinforced core themes: demand for interactive tools (e.g., chatbots), equitable access, and ethical governance. These align with literature advocating inclusive policy frameworks and engagement through personalized learning (de Oliveira Silva & dos Santos Janes, 2022). The 40% concern about reduced human interaction highlights the need to balance technological efficiency with socio-emotional pedagogy, requiring PK strategies that integrate AI as a scaffold within dialogic approaches (Vygotsky, 1978).

This study confirms AI's transformative potential in EFL instruction, with 92% of educators expressing optimism about enhanced engagement, personalization, and efficiency. However, realizing this potential demands addressing critical barriers: pronounced ethical concerns (bias, privacy), stark contextual inequities (public-private adoption gap), and a fundamental TPACK misalignment manifesting as pedagogical-ethical readiness gaps (training demand) whereby teachers recognized technological potential (TK) but lacked the integrated pedagogical knowledge (PK) and contextual support to implement it effectively and ethically within the specific demands of EFL instruction (CK).

This study acknowledges several limitations. Primarily, the sample size (n=25), while appropriate for achieving thematic saturation in the qualitative components (Guest et al., 2006) and justified by the homogeneity of Iran's national EFL curriculum, restricts the generalizability of the findings, particularly the quantitative correlational analyses (e.g., experience vs. optimism). These specific correlations should be interpreted cautiously due to the limited number. Furthermore, the exclusive focus on the Iranian context, with its unique centralized curriculum and

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resource disparities, limits the direct transferability of findings. A third limitation lies in the methodology; while capturing valuable teacher perceptions and reported practices, the study did not involve direct observation of AI integration in actual classrooms or measure its impact on student learning outcomes. Finally, reliance on self-reported data means the findings reflect perceptions of AI's opportunities and challenges, not necessarily observed behaviors or objective effectiveness metrics.

These limitations point to specific directions for future research. To address the scope and methodological constraints, larger-scale, cross-contextual studies are needed to validate the observed relationships and explore how findings translate across diverse educational systems (Creswell & Creswell, 2017). Crucially, future research should employ mixed-methods designs incorporating classroom observations and measures of student learning outcomes (e.g., language proficiency gains, engagement metrics) to move beyond self-report and provide a more holistic, objective understanding of AI's actual pedagogical impact and its ethical implications in practice (Gašević et al., 2023; Morrison, 2017). Such designs would allow for triangulation between teacher perceptions, observed integration practices, and student results (Bryman, 2016). Additionally, research specifically examining strategies for effective, ethics-integrated professional development (as strongly requested by participants) and robust frameworks for auditing AI tools for bias and ensuring equitable access is essential to bridge the identified TPACK gaps and translate AI's potential into equitable, effective practice in EFL contexts globally.

Ultimately, TPACK-guided insights reframe the question from if AI transforms EFL to how:

a. Pedagogically: Train teachers to align AI with communicative methodologies (TK-PK integration).

b. Technologically: Audit tools for linguistic/cultural bias (TK-CK alignment).

c. Contextually: Ensure equitable access while safeguarding teacher autonomy.

Authors' Contributions

All authors share the responsibility of writing the paper, including preparing the first drafts, revising, collecting the data, conducting data analysis, and writing and revising the final draft. Generally, 50% of the work at different phases was done by the first (corresponding author), 20% goes to each of the second and third authors, and 10% was contributed by the fourth author.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

Acknowledgments

We would like to express our gratitude to all individuals helped us to do the project.

Declaration of Interest

The authors report no conflict of interest.

Funding

According to the authors, this article has no financial support.

Ethics Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants.

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E-ISSN: 3041-9433