

Enhancing English instructors' TPACK through AI: Exploring its role in Language Education

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Research Paper

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Abstract: Web-based and AI technologies were primarily designed for entertainment and social interactions, rather than for educational purposes. The TPACK (technological Pedagogical Content Knowledge) framework emphasizes the need for a creative and strategic use of technology, focusing not solely on the technology itself, but on its potential to enhance student learning and develop teachers' skills in using these tools effectively. In pursuit of this objective, the present study concentrated on enhancing the TPACK of English language teachers through the utilization of an AI-mediated system. In the initial phase, the TPACK scale was employed to gauge the proficiency of thirty-two Iranian EFL teachers, with a specific emphasis on the technology component. In the second phase, we implemented a methodical approach comprising training programs, workshops, hands-on experience, mentorship initiatives, feedback mechanisms, and the infusion of AI into lesson plans and assessment strategies for five focal participants. Subsequently, the evaluation of English language teachers' TPACK was conducted through teacher reflective statements, instructional observations, and student feedback. Given the current status of technology as an integral component of teachers' TPACK, this study provided a comprehensive understanding of how AI-assisted language instruction might enhance English teachers' TPACK. The findings of this study have various theoretical and pedagogical implications for stakeholders in the context of teacher education.

Keywords: AI-mediated Language Instruction, AI-powered Assessment Tools, English Language Teachers' TPACK, Facilitating Functions of AI, Technological Content Knowledge

Introduction

In recent years, there has been a significant focus in language academia on integrating information technology in language learning and teaching (Shadiev & Yang, 2020; Nguyen & Van Le, 2023). AI is one such program that has shown great potential in improving students' learning outcomes in language learning and teaching (Knox, 2020; Huang et al., 2023). One of the key benefits of AI is its ability to provide personalized learning experiences by adapting to each learner's unique learning preferences and skill levels. This personalization can lead to more efficient language learning experiences (Chun et al., 2016; Rahimi & Fathi, 2022). Second, Instantaneous feedback from AI helps students correct mistakes and advance their language skills more successfully. Learning is dynamic and interesting because of this instant feedback mechanism (Bigverdi, & Khalili Sabet, 2024; Divekar et al., 2021; Darwin et al., 2023).

Additionally, AI-powered language instruction platforms such as ChatGPT, Gradescope, Quizizz, and Curipod commonly use machine learning techniques, speech recognition technology, and natural language processing (NLP) technology to support learners in promoting their language skills and subskills. (Tafazoli et al., 2019; Hong, 2023; Yan, 2023). Furthermore, an overemphasis on the

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importance of students' roles in utilizing AI could undermine the necessity of teachers' roles in integrating AI into the classroom, roles that are prone to deterioration over time. Beyond this, educators are extremely important in determining how students learn. The rapidly changing nature of education makes it abundantly evident that teachers' TPACK needs to be enhanced as technology in the classroom becomes more diverse and ubiquitous (Ilahude et al., 2023). Teaching professionals need to keep abreast of the latest developments in the area to use technology in the classroom (Alam & Mohanty, 2023). As a result, teachers need to be able to enhance their TPACK to meet the needs of different student populations, topic areas, and grade levels.

That being said, educators need to engage in continuous TPACK learning to improve both their teaching practices and student outcomes. Collaboration with other educators, idea sharing, and self-reflection on one's own TPACK can all help educators pinpoint their areas of strength and weakness as well as development opportunities (Sari et al., 2021).

AI can offer a range of benefits to educators and learners, including enhanced creativity, customization, feedback, and collaboration (Ilahude et al., 2023). Additionally, AI can present novel challenges and prospects in the educational setting (Sari & Sumardi, 2020). However, it is important for teachers to critically reflect on the information generated by AI systems, including its validity, quality, and dependability, as well as any potential risks or biases (Koehler & Mishra 2009). To effectively integrate AI technology into teaching and learning without compromising its value, educators must possess a strong TPACK. This includes considering when, how, and why to implement AI in the classroom, all of which can be informed by a robust TPACK (Yao, 2021).

Given this, teachers must become proficient in using technology and effectively incorporating it into their lesson plans. Furthermore, teachers must recognize the value of educational technology and the advantages it can provide for instruction before they can be receptive to incorporating cutting-edge technology into their classes. To make matters worse, many educators and administrators are still unfamiliar with AI-based learning assistance and may just view it as a little more sophisticated form of teaching technology (Alharbi, 2023). Therefore, teachers should use AI assistance systems themselves to have a thorough understanding of how they may scaffold English language instruction before implementing them successfully and evaluating their efficacy.

Thus, the current research makes substantial contributions to the existing literature on several fronts. Firstly, it addresses a significant gap in the literature by providing empirical evidence on the precise impact of AI-assisted language learning tools on the TPACK of English language teachers (Mishra et al., 2024; Jain & Raghuram, 2024). Although prior studies have explored the effectiveness of AI-powered language learning resources for EFL learners, this analysis focuses specifically on EFL English language teachers, offering a unique perspective on this particular context. Secondly, this research expands our understanding of the theoretical applications of AI in language instruction. By employing a combination of methodologies in our study, we delved deeper into the specific ways that AI-mediated instruction enhances the TPACK of English language teachers, even though the literature has acknowledged the positive effects of AI on language acquisition.

The primary objective of this study was to evaluate whether the disparities recorded before and after the integration of AI can be attributed to educational technology or the pedagogical practices employed by English language instructors. By scrutinizing these elements, the research aims to cast light on whether the influence of AI-enhanced education is primarily attributable to innovative teaching methods or technological advancements. This will enable a more comprehensive understanding of the distinctive benefits that this approach may offer to the field of language instruction.

Literature Review

Technological Pedagogical Content Knowledge

Robust TPACK is essential for successful AI integration because it supports educators in creating and implementing engaging and pedagogically sound lessons that leverage AI technology. Technological Pedagogical Content Knowledge, or TPACK for short, is a framework that characterizes how technology, pedagogy, and content can be used to improve teaching and learning. It involves three different kinds of knowledge: content, pedagogical, and technological.

Lee Shulman's 1986 Pedagogical Content Knowledge (PCK) model served as the foundation for Punya Mishra and Matthew J. Koehler's 2006 development of the TPACK framework. To overcome the dearth of adequate theory guiding successful technology integration in the classroom, the TPACK framework was developed. Since its release, a lot of research and professional development activities have made extensive use of the TPACK framework, which has emerged as one of the most influential theories about technology and education (Gromik et al., 2023; Kim et al., 2024).

Moreover, to effectively integrate technology into the realm of education, it is essential that the TPACK components function in unison. These components, elucidated by Koehler and Mishra (2009), encompass the following areas:

- 1) Pedagogical Knowledge (PK): Knowledge of the process and practices of instruction, including educational objectives.
- 2) Content Knowledge (Ck): knowledge of pertinent subject matter that is essential for instruction.
- 3) Technological Knowledge (TK): Proficiency in standard technologies and their operation.
- 4) Pedagogical Content Knowledge (PCK): Comprehensive understanding of pedagogy relevant to the specific subject matter being taught.
- 5) Technological Pedagogical Knowledge (TPK): Understanding how pedagogy can be altered as a consequence of employing specific technologies.
- 6) Technological Content Knowledge (TCK): understanding the relationship between technology and content is essential.

Thus, they must possess the ability to integrate these six knowledge domains in diverse ways to craft impactful learning opportunities for their pupils (Mishra & Koehler, 2006). For instance, educators must be able to choose and apply relevant technological resources that complement curriculum material, learning objectives, and students' needs and interests. Additionally, they must understand how to use technology to support and evaluate students' learning outcomes (Ng et al., 2023).

The Implications of TPACK in English Language Instruction

In this framework, the TPACK construct has been studied in several projects. The following studies illustrate how technology would possibly hone TPACK. For instance, in a mixed-methods study, Ali and Waer (2023) explored how EFL pre-service teachers' knowledge of lesson planning and teaching practices was significantly improved by integrating technology into their instruction. In another study, Using TPACK workshops as an intervention, Najjari et al. (2021) looked at the role that instructors' TPACK literacy and skills played. Thus, the research demonstrated that following the intervention, English language instructors' TPACK literacy increased significantly owing to the TPACK workshops.

Likewise, Kurt et al. (2013) provided 22 Turkish pre-service EFL teachers with training focused on enhancing TPACK skills. As a result, they supplied them with a TPACK model briefing. Subsequently, they constructed technical resources, collaboratively explored multiple technologies, devised a curriculum integrating multiple technologies, and instructed in an authentic educational setting. The results showed that the scores for TK, TCK, TPK, and TPACK had significantly improved.

Teachers' technology integration tactics must be constantly adjusted to changing situations and contexts; hence these procedures are dynamic and iterative rather than sequential or linear. Books,

articles, blogs, podcasts, videos, and online courses are just a few of the tools available to educators to learn more about TPACK, artificial intelligence, and its uses in the classroom.

Artificial Intelligence

Artificial intelligence, or AI for short, is the science and engineering of building intelligent computers and systems that are capable of learning, thinking, and solving problems—tasks that would typically need human intelligence. AI is capable of producing unique, interactive material, including text, audio, code, graphics, simulations, and video, using vast data sets and machine learning techniques (Aldosari, 2020). AI has the enormous potential to revolutionize traditional teaching approaches by offering individualized learning experiences that cater to each student's wants and needs (Hwang et al., 2020). Moreover, several studies have been conducted to investigate how English language learners' motivation and engagement are affected by AI-assisted language learning technologies, in addition to their language abilities and subskills (Junaidi et al., 2020; Ebadi & Amini, 2022; Hsu et al., 2023; Ghafouri, 2024).

How AI Affects English Language Teaching

Depending on the goal, subject, and context of the learning activity, English language teachers can use AI in their classroom in a variety of ways. AI has the potential to improve teaching in several ways, including curriculum design and lesson planning, implementing creative and interesting activities in the classroom, providing individualized and adaptive feedback and assessment, and addressing the ethical and social aspects of AI in education (Ling, 2023).

Based on the existing knowledge and practices of English language teachers regarding AI some new findings are established. The first exploration looks at how AI-assisted language instruction can improve the role of language teachers as learning facilitators. Ghafouri et al. (2024) have explored the potential of positive psychology interventions and AI tools to promote the psycho-emotional aspects of second language teachers and learners. They used ChatGPT in a three-phased writing instruction protocol (CGWIP) to foster positive emotions and interactions between Iranian English language teachers and learners. The study found that CGWIP significantly enhanced teachers' self-efficacy and improved learners' writing skills, suggesting that the protocol can nurture teachers' efficiency and improve learners' writing skills. By the same token, Ghafouri (2024) explored the effectiveness of a four-staged ChatGPT-based rapport-building protocol (CGRBP) on teacher-student rapport and L2 grit in intermediate-level Iranian EFL learners. The results showed that students taught English through CGRBP outperformed those in the control group on L2 grit. The study suggested that well-structured and staged ChatGPT-based instruction may lead to enhanced teacher-student rapport playing an assistive role in learning.

Furthermore, AI can improve assessment techniques by analyzing learners' learning outcomes, successes, and failures. To integrate artificial intelligence-based assessment in education, Sánchez-Prieto et al. (2020) pursued a Technology Acceptance Model (TAM-based model) and instrument. The study focused on perceived usefulness, ease of use, attitude toward use, behavioral intention, and actual use, emphasizing the growing trend toward online learning.

In a similar vein, Jiang et al. (2023) explored the role of AI in facilitating writing assessment through four large language models (LLMs) - GPT-4, GPT-3.5, IFLYTEK, and Baidu Cloud. Writing samples were collected from US high school students, and performance metrics were compared to human ratings. Results showed that GPT models and IFLYTEK achieved similar accuracy scores, with GPT-4 excelling in precision.

Finally, AI lessens the effort and challenges teachers face in the classroom. Hashem et al. (2023) attempted to detect the effectiveness of ChatGPT as a mechanism to reduce teacher workload. The study explored the use of AI generative ChatGPT to prevent burnout in secondary schools. ChatGPT was tested for personalized planning and content development in English, science, and math subjects, highlighting its benefits through task-specific prompts and AI-human collaboration, optimizing teacher

planning, enhancing instructional support, and reducing burnout. In that respect, to free up more time for other crucial facets of teaching, such as student support and classroom instruction, teachers can use ChatGPT to expedite the planning process. AI technology can give instructors useful tools to assist them manage their workload (Papamitsiou & Economides, 2014).

These are just some of the examples of how English language teachers can use AI in their teaching practice. However, teachers also need to be aware of the challenges and limitations of AI, such as the quality, validity, and reliability of the AI-generated content, and the potential risks and biases of the AI systems (Farrokhnia et al., 2023; Rahman & Watanobe, 2023). Therefore, teachers need to be critical and reflective about the use of AI and to follow the ethical and professional guidelines and policies regarding AI in education.

AI and TPACK Integration

Both TPACK and AI are pertinent and significant to English language teaching (ELT) for educators, as they may support educators in creating and implementing AI-infused lessons that are both pedagogically sound and meaningful. Along with addressing the ethical and social ramifications of AI in education, TPACK and AI can also present instructors and students with new problems and opportunities. Some of these include improving creativity, personalization, feedback, and cooperation.

To date, several studies have investigated the relationship between TPACK and AI in ELT for teachers. In this vein, the behavioral intention of English as a foreign language (EFL) instructor to employ AI to help English teaching and learning in middle schools in China was investigated by An et al. (2022). As the theoretical foundation, they combined the Unified Theory of Acceptance and Use of Technology with TPACK. They discovered that, although effort expectancy, facilitating conditions, and AI technological pedagogical knowledge had indirect effects, performance expectancy, social influence, and AI-TPACK had significant positive effects on behavioral intention.

Within this context, to help EFL teachers evaluate their TPACK by combining technology and thinking skills, Wang (2022) created a two-dimensional TPACK scale. Eight constructs made up the scale: thinking skills, CK, PK, TK, PCK, TCK, TPK, and TPACK. The scale was shown to have excellent reliability and validity, and the EFL teachers' confidence in their TPACK teaching of higher-order thinking skills was found to be lower. The findings also demonstrated that high-achieving EFL teachers reported strong TPACK self-efficacy, and EFL teachers from various cultural backgrounds expressed varying degrees of confidence in their ability to think critically and in TPACK.

Recently, in order to clarify the intricate relationships and complementary impacts of pedagogical approaches, subject-specific content, and AI technology in the field of education, Ning et al. (2024) explored a framework for integrating the TPACK and AI technology. To investigate the connections between teachers' AI-TPACK knowledge components, they created a useful structural equation modeling (SEM) technique. It was determined from the outcome that six knowledge aspects work together to predict AI-TPACK variables. Yet, in respect to teachers' AI-TPACK, distinct knowledge components displayed differing degrees of explanatory power. When compared to technology-related knowledge elements, non-technical knowledge elements have a substantially lower explanatory potential for teachers of AI-TPACK. The explanatory power of PCK and AI-TCK is significantly reduced by content knowledge (C). As a result, an in-depth study of the intricate relationships between the many components of AI-TPACK leads to a more profound comprehension of the generative mechanisms that underpin teachers' AI-TPACK. The framework functions as a thorough guide for the large-scale assessment of instructors' AI-TPACK.

These studies suggest that TPACK and AI are interrelated and influential for teachers in ELT and that there is a need for more research and practice on how to integrate AI technology in a pedagogically sound way using TPACK.

Present Study

The importance of the current study is supported by multiple arguments. As previously stated, few qualitative initiatives have been undertaken to advance English language teachers' understanding of AI, and the bulk of interpretations about the interaction between TPACK and AI in English language instruction have been restricted to the learners' achievements (Suryana et al., 2020; Zheng et al., 2021; Fitria, 2023). Furthermore, following this logic, supporting and nurturing the TPACK and AI of English language instructors would give them the foundation for ongoing professional growth and enable them to produce knowledge that is specific to integrating AI into ELT. Therefore, Using AI-powered technologies in English language lessons, the current work aims to improve TPACK for English language teachers and make up for these shortcomings.

One of the early initiatives in ELT research that frames the combination of TPACK and AI in the ELT setting is this work. It will also demonstrate the efficacy of these technical developments in a methodical and regulated way. The trial might offer stronger evidence to back up the claims made by academics who think language teachers will gain from using AI in English language instruction.

Research Questions

In keeping with the aims explained above, the following research questions were addressed in this study:

Research Question One: To what extent do Iranian EFL teachers demonstrate the use of AI-mediated systems as a part of their TPACK components?

Research Question Two: What are the Iranian EFL teachers' perceptions of AI's transformative role in English language teaching?

Research Question Three: How can an AI-enabled supportive system enhance Iranian English language teachers' TPACK?

Materials and methods

Design

The present investigation utilized an exploratory mixed-methods approach, with two phases dedicated to quantitative and qualitative analysis, respectively. Triangulation is considered as a fundamental tenet of the mixed-methods design approach (Riazi et al., 2023). By triangulating the data using various methodologies, researchers can more systematically identify important elements of a phenomenon (Riazi, 2016). Therefore, using both quantitative and qualitative methods, this study was aimed to investigate the impact of AI-mediated language education on English language teachers' TPACK.

Consequently, this study was conducted in three phases. First, the participants' perceptions regarding the internal structure of the TPACK framework and its relations with technology in English language teaching were investigated using a scale. Second, they were trained on how to use and integrate AI in their teaching classes. Finally, the effectiveness of applying AI in participants' teaching classes was observed and multiple data sources were triangulated to develop a comprehensive understanding of the phenomenon (Patton, 1999).

Participants

Thirty-two English language teachers, ranging in age from 27 to 45, participated in the quantitative phase (12 female and 20 male). Having earned a Bachelor of Arts (42%) or a Master of Arts (58%) in Teaching English as a Foreign Language (TEFL) or English language literature, they had eight to fifteen years of experience teaching EFL. Considering that the initial phase's participants were scheduled to

enroll in online teacher training programs, availability sampling was utilized to choose them. The participants for the intervention phase were chosen based on an inclusion criterion.

Qualitative research typically involves small sample sizes and aims to explore the convergence and divergence of participants' responses (Tindall, 2009). As noted by Taylor et al. (2015), increasing the number of participants beyond a certain point does not necessarily enhance understanding or perception. Consequently, this study selected only five English as Foreign Language (EFL) teachers for the qualitative phase. The selection of these focal teachers was based on their responses to the teacher TPACK scale, adhering to specific inclusion criteria detailed in the data analysis section. Table 1 presents the participants profile from both the quantitative and qualitative phases of the study.

Table 1

Demographic Information

| phase | Number | Age | Years of experience | Mean experience | Standard deviation |
|--------------|--------|-------|---------------------|-----------------|--------------------|
| Quantitative | 32 | 27-45 | 5-20 | 8.1 | 1.54 |
| Qualitative | 5 | 32-40 | 8-15 | 9.2 | 1.23 |

Regarding ethical considerations, the participants were assured and informed that their identities would remain confidential and that the data were merely gathered for research purposes. Moreover, the direct quotes chosen to be reported in this study would be revealed and tracked down by the participants' consent.

Instruments

The scale used in the quantitative phase of this study was based on the adapted version of Schmid et al. (2020). However, in the present study, the technological-related aspects of TPACK construct were considered and the unnecessary items were not included in the instrument. As such, the final edition of the present study included 5 scales, encompassing the *Schmidt et al.'s scale* (2009) containing 11 statements on TK, TPK & TPCK, the *Chai et al.'s scale* (2011) with 2 items on PCK & TPCK, and the *Schmid et al.'s scale* (2020) made up of 6 items on TCK & PCK.

Cronbach's alpha values of the study for the TPACK scale are illustrated in Table 2.

Table 2

Reliability Statistics for the TPACK Scale

| Subscale | TK | PCK | TPK | TCK | TPCK | Overall |
|------------------|-----|-----|-----|-----|------|---------|
| Cronbach's alpha | .81 | .89 | .78 | .92 | .96 | .87 |

As Dornyei and Taghuchi (2009) and Harrison et al. (2020) stated that a Cronbach's alpha of 0.70 is an adequate reliability index for a scale, all the reliability indices are adequate. Furthermore, the content validity of the scale was evaluated by two associate professors in applied linguistics.

For the qualitative phase of the current research several data collection methods were utilized including reflective teaching statements, class observations, and students' feedback.

More specifically, after the AI intervention training phase, firstly, the teachers' reflective teaching statements were used to discover beliefs and practices related to their teaching. It included not only the teacher's assumptions of the teaching and learning process but also practical techniques of how these beliefs were put into practice (Grundman, 2006).

Secondly, the observation of instructional practices presents an opportunity to reflect upon the TPACK framework and to integrate AI and apply AI (Shanahan & Tochelli, 2013). For this purpose, structured observational field notes were used to explore how the teachers added AI to their instruction. During the first two sessions, the teachers were allowed to practice using AI in the areas of their interest and choice in addition to the areas determined by the observers. The act of observation during the twelve

weeks encompassed both learning and teaching areas specifically those elements related to AI-enabled software that can interact with learners in class to provide a helping role in instruction through a new principle in class.

Last but not least, to ensure the efficacy of using AI in English language classes, student feedback would be a valuable resource for this study (Huang & Tan, 2023). In light of this, researchers created portals for student feedback. Knack was an ideal platform due to its drag-and-drop functionality offering accessible communication tools, personalized dashboards, course records, materials, and more. However, since some students might not participate in joining such portals, within this context, teachers made it mandatory for all students to join Knack and actively be involved in giving feedback.

Procedure

At the beginning of this research, teachers were informed about the study's distinct phases and were invited to an introductory meeting prior to completing the TPACK scale, which was administered under the assurance of confidentiality. Participants were given ample time to complete the scale in one sitting. In the second phase, an AI education expert was recruited to conduct online training programs. This expert possessed knowledge in several key areas, including AI fundamentals, technical proficiency, educational pedagogy, and communication skills. A structured approach guided the training programs, focusing on educational AI tools and English language learning platforms. The first step involved online workshops aimed at familiarizing teachers with current AI language tools and integrating these technologies into their curricula to enhance their instructional effectiveness. Following this, collaborative communities were established on social media to enable teachers to share insights, experiences, and challenges regarding AI integration in language education, thereby facilitating knowledge exchange and providing problem-solving support.

In the third phase of the study, a reflective teaching statement served as the primary tool to assess teachers' development in utilizing AI within English language classes. According to Grundman (2006), this statement should outline the teacher's beliefs about the learning process, justify how teaching fosters learning, explain the teacher's pedagogical approach, articulate objectives for both the teacher and students, and demonstrate how the teacher engages with innovative practices. Additionally, structured observation was employed to gather insights into the instructional methods of five English language teachers across twelve sessions, requiring five trained observers. During the first two weeks, observers focused on elements of TPACK and AI, after which the first researcher provided guidance through literature reviews on applying AI in English Language Teaching (ELT). Weekly reports from the observers were collected to evaluate the integration of technology and AI in teaching materials. The observation framework was based on earlier research, with field notes focusing on various aspects such as learners, lesson presentations, learning aims, task processes, and assessment methods.

Finally, Knack, a web-based platform for learners to access educational services, was used to confirm the immediate effect that AI might have on learners by gathering learners' feedback. The learners were asked to create a student portal with Knack. In our country because of the sanction restrictions, the learners were allowed to access the free Knack for 14 days ([sign up for a free Knack account](#)). Thus, this phase was done nearly at the end of the 12 teaching and learning sessions.

Data Analysis

For the statistical analysis of the quantitative data, SPSS software version 26 was utilized. The mean percentage of scores measured by each subscale, the overall scale score for each participant, and the mean score for the group as a whole were all computed as descriptive statistics. The participants for the intervention phase were chosen based on an inclusion criterion. For this reason, participants enrolled in the online training program were those whose total score (x) was less than the group's mean score (278.54). Out of the thirty-two teachers, eighteen had a total score below 278.54, according to the findings of the participant's overall scores. Thirteen of the eighteen individuals declined to participate in the intervention, whereas five of the participants consented to begin the training phase.

To analyze the qualitative phase of the data, the reflective teaching statements were examined first. To shed light on how an AI-mediated system could enhance teachers' TPACK over time, the researchers applied Schön's 2017 framework, which includes: (1) given the study's design, attention was directed toward the concept of reflection-on-action (considering teaching after it has occurred). This pertains to evaluations of teaching decisions, student reactions, and potential improvements, (2) organizing and assessing patterns that may indicate how AI can support or improve English language instruction. These could encompass "student engagement," "modifying teaching methods," or "managing the classroom," (3) recognizing and explaining how AI may aid the enhancement of teachers' TPACK, and (4) compiling the insights gathered from the analysis. This might involve examining how AI has transformed teachers' practices over time, identifying their strengths and weaknesses, and detailing specific strategies that AI could enhance in future lessons.

To analyze structured observation data qualitatively, the researchers explored patterns, themes, and meanings in behaviors, highlighting significance and context to gain a comprehensive, in-depth insight into the observed phenomenon. The thematic analysis was conducted following the six-step process suggested by Silverman (2013), which included: (1) becoming acquainted with the scope and intricacies of the data by reading the transcripts, detailed notes, and coded sheets several times, (2) creating a predefined analytical coding system based on the observation schedule to extract meanings and patterns behind the behaviors, (3) identifying overarching themes that illuminate our research questions by observing behaviors, variations in interactions, and context-specific patterns, (4) interpreting the data to connect the observed behaviors with broader practical implications while considering situational influences and participant roles, (5) revisiting the themes and codes against the raw data to confirm and validate our findings, and (6) reporting the results by detailing each theme. Through identifying patterns among the developing codes, the researchers could recognize the recurrent themes related to Iranian EFL teachers' perceptions of the transformative role of AI in English language teaching classes.

To evaluate the effectiveness of AI in English language instruction, we analyzed students' open-ended feedback through qualitative thematic analysis, which is widely regarded as a prevalent technique in narrative research (Reissman, 2008). For this analysis, we collected all the open-ended feedback from students and thoroughly reviewed the transcripts multiple times. We searched for frequently mentioned comments that likely underscore the effectiveness of AI in the instructional methods of teachers. We assigned codes to relevant short phrases and utterances that addressed the research questions. By consolidating these coded categories, we identified recurring themes associated with the influence of AI on English language educators.

Research Trustworthiness

To ensure the trustworthiness of this study, the researchers adhered to Lincoln and Guba's (1985) framework alongside the recommendations of Riazi et al. (2023). Initially, to establish credibility, the researchers engaged in prolonged interactions to cultivate rapport and trust, thereby enabling a comprehensive understanding of the participants' experiences and perspectives. In terms of transferability, a detailed and comprehensive account of the research context was provided. To ensure that the sample accurately represented the population of interest, Creswell and Miller's (2000) framework for purposive sampling was utilized. To achieve dependability and confirmability, transparency in data collection, analysis, and interpretation was maintained throughout all stages of the research. Furthermore, external validation, as suggested by Janesick (2015), was implemented through peer debriefing. An academic professional, experienced in teaching English as a Foreign Language (EFL) and in researching issues related to AI-mediated language instruction, served as the external evaluator. This evaluator reviewed the transcriptions, codes, emerging categories, and themes to mitigate any potential bias or subjectivity resulting from our extensive involvement in the research context.

Results

Quantitative Results

The current study is designed to investigate the extent to which EFL teachers incorporate AI-mediated systems into their TPACK, as specified in Research Question 1 (RQ1). A summary of participants' responses to the TPACK scale is presented in Table 3.

Table 3

Percentage of Scores on the Teacher's TPACK Scale

| Subscale | Strongly disagree | Disagree | Somewhat agree | agree | Strongly agree |
|----------|-------------------|----------|----------------|-------|----------------|
| TK | 15.4 | 37.2 | 20.5 | 17.6 | 6.3 |
| PCK | 2.4 | 8.3 | 21.22 | 46.2 | 3.1 |
| TPK | 28.6 | 47.85 | 14.94 | 0.7 | 0 |
| TCK | 35.23 | 41.56 | 12.92 | 6.2 | 1 |
| TPCK | 16.37 | 13.54 | 38.89 | 14.23 | 12.74 |

Regarding TK, the findings revealed that slightly more than 50% of the teachers lacked familiarity with integrating technology into their teaching. Approximately a quarter of the teachers demonstrated familiarity with using technology in their instruction, while the rest of the teachers fell somewhere in between in their proficiency with incorporating technology to teach English language.

Upon closer examination of the PCK concept, approximately half of the respondents gravitated towards the agreement end of the scale, while just over one-fifth favored the midpoint. A minority, around 11%, leaned towards the disagreement end of the scale. As a result, it can be inferred that most of the teachers believed they had a profound understanding of PCK.

Concerning TPK, the agreement points on the scale did not receive many responses, while over three quarters of the answers fell on the disagreement extremes. This indicates that most participants lacked sufficient knowledge about how using technologies could benefit their profession.

With regard to TCK, it was observed that over three quarters of the surveyed teachers lacked awareness of TCK. This suggests that the majority of participants in the study were not proficient in understanding how the integration of technology can influence the subject matter being taught.

In the examination of TPCK, findings revealed that approximately 40% of the responses were situated within the median range, while the remaining 60% were nearly evenly distributed between disagreement and agreement. This distribution implies that close to one-third of educators lacked clarity on how technology could enhance the teaching of subject matter, while an additional one-third expressed confidence in their ability to utilize technology for content and pedagogy.

An analysis of the observed total scores recorded on the TPACK scale revealed that 18 educators obtained a total score lower than the mean score of 278.54. The respective total scores of these participants are detailed in the subsequent Table 4.

Table 4

Participants with a Total Score of below the Mean

| participants | scores |
|--------------|--------|
| 1 | 236 |
| 2 | 245 |
| 3 | 267* |
| 4 | 273 |
| 5 | 263 |
| 6 | 259* |
| 7 | 242 |
| 8 | 223* |
| 9 | 271 |
| 10 | 234 |
| 11 | 266 |

| | |
|----|------|
| 12 | 231* |
| 13 | 275 |
| 14 | 269 |
| 15 | 250 |
| 16 | 244 |
| 17 | 228* |
| 18 | 262 |

As indicated in the data analysis section, five of the eighteen educators, denoted with an asterisk, consented to partake in the AI-mediated training program.

Qualitative Results

In the second phase of the study, analysis of the fieldnotes, reflections, and student feedback from English language teachers demonstrated the integration of AI-mediated instruction within the TPACK framework by the five EFL teachers. The findings of this section are classified into three themes, which serve as the theoretical foundation of the study. Substantiating evidence is delineated within quotation marks. These findings yielded insights into the implementation of AI in English language teaching and the consequential impact of the intervention on the advancement of TPACK among English language teachers (RQs 2&3).

Teachers' Upgraded Skills in Applying AI Following the Intervention

To grasp a prevailing view of the nuances and intricacies of the teachers who participated in AI-enabled support system training program, reflection statements, observation notes, and student feedback encapsulated three themes displayed in Table 5.

Table 5

Themes Extracted from the Available Instrument after the Intervention

| | | Reflective teaching statement | Observation of instruction | Student feedback |
|----------|---|-------------------------------|----------------------------|------------------|
| Theme #1 | AI plays an assistive role in ELT | ✓ | ✓ | ✓ |
| Theme #2 | AI can hone assistive method | ✓ | ✓ | ✓ |
| Theme #3 | AI reduces teachers' workload and teaching difficulties | ✓ | ✓ | ✓ |

Note. the check marks show the supportive roles of each instrument

AI plays an assistive role in ELT

Reflective Teaching Statement

AI-enabled software can support customized instruction through assorted tools such as mobile devices and computers. These AI-enabled tools can interact with students during class and provide a supportive role for teachers and students as learning catalysts, academic assessors, and advisors through an in-depth examination of educational analysis from the learning environment (Kim & Kim, 2022).

As participant #1 stated, “*The AI platform recommended structure and tools that enabled me to navigate step-by-step instructions with assurance.*”

The teachers reported how AI facilitated planning the syllabus, setting teaching goals, explaining the procedures, and monitoring students' progress. They highlighted how AI transformed monotonous procedures into more engaging practices.

Teacher # 4 shared, *"I used to struggle with adding variety to the teaching procedures every session, but after using the AI-mediated systems, the teaching steps in my classes improved unbelievably. This program had an amazing transformation role in developing students' motivation and involving them beyond the classroom setting."*

Observation of Instruction

By concentrating on the moments in which lesson stages could reflect the situations in which AI-mediated software facilitates or impedes ELT, researchers could focus on how, why, and when teachers implemented AI-assisted software to enhance their teaching process.

As observer #2 commented, *"During the task process in class, the intervention of AI was conspicuous. Both teachers and students were waiting for suggestions from software to accelerate the rate of delivery. No time was wasted to look for topics, structures, and words to continue doing the tasks and achieving the goals set by the teacher."*

Observer #1 expressed, *"The teacher did not seem to be baffled or uncomfortable whenever the AI platform was active. The recommendations and solutions for unpredictable circumstances paved the way in such a way that the teacher felt a very knowledgeable assistant is always ready to provide the class with supporting and informing ideas."*

Student Feedback

Student feedback was in line with the findings extracted from observation sheets and teachers' reflections. This was especially evident in this extract gathered from one of the students' portals in Knack:

"Without AI tools, the teacher seemed to lack something. Although the teacher's steps of presenting, testing, and reviewing were not changed, the teacher was far more dominant in teaching. Thanks to AI!"

Another student commented on the class experience process as a memorable and effective process through which the teacher's verbal dexterity astonished them all. She added that more than one teacher appeared to warm up, teach, and test.

Another student indicated that a teacher's English language knowledge and experience were necessary for teaching a language but not enough. She noticed a permanent gap in English language classes that was luckily filled with the AI spectacular intervention. As shown in her words:

"I believe that AI smoothed the way for the teacher to present, practice, and test the unit without creating confusion or anxiety during his instruction."

AI Can Hone Assessment Method

Reflective Teaching Statement

AI-driven assessment tools can improve traditional evaluation methods done in classrooms by inspecting students' learning patterns derived from their success or failure during testing phases in class (Sánchez-Prieto et al., 2020). These assessment tools enhance a culture of constant trial and error ensuring that every student has the potential and opportunity to meet their varied needs in learning. In the current study, teachers implemented The Gradescope Mobile App for two general purposes: 1) creating and grading paper exams, and 2) creating homework assignments. In this vein, teacher #4 commented,

"The main advantage of AI-mediated assessment tools over teachers' is that they can provide accurate, reliable results within minutes. Also, the test is available for them to take on-site or off-site anywhere and any time of day which allows them to suit their schedule."

Another noticeable aspect of AI-based scoring is that it does not have a personality; therefore, the AI process of scoring tests is completely free from bias. As teacher #6 stated,

"Artificial Intelligence is always fair, even when human criteria vary in generosity and strictness. For every test taker, automatic evaluation produces consistent results."

Observation of Instruction

By focusing on the instances where homework assignments could represent the circumstances in which AI-powered assessment tools such as curipod.com could enhance practice and evaluation in classrooms. With the help of this platform, educators could use AI to quickly construct interactive classes. Instructors only needed to input a topic to create a ready-to-use lesson that included text, graphics, and interactive elements like word clouds, polls, and open-ended answers.

Observer #3 expressed, *"This platform could easily build interactive assignments and presentations in seconds. The only things that the teachers needed were the topic of the lesson and their proficiency level. Finally, AI provided a lot of slides and suggestions for the class to participate in and discuss the topic."*

Moreover, based on each student's answers, teachers can develop quizzes that will generate a personalized learning path. Instructors can also construct classes using Quizizz.com, which has recently added AI-powered assessment tools to modify question difficulty, verify grammar, and adapt questions to better reflect real-world situations.

Observer #5 added, *"The children find this platform's game-like style to be incredibly stimulating. Being competitive, they take pleasure in monitoring their standing."*

Observer #4 commented, *"Students have the opportunity to retake assignments until they are satisfied with their level of understanding, in addition to receiving immediate feedback."*

Student Feedback

Students reported numerous benefits from the use of AI-powered assessment tools, particularly highlighting the platform's ability to detect academic dishonesty during examination.

Student #23 elaborated stating that, *"When a test-taker shows suspicious behaviors, such as repeatedly shifting tabs within the test window, blocking a camera, or looking away from the camera, the AI detection system can identify it."*

They enthusiastically praised the immediate feedback provided by the AI. They appreciated the dynamic content and gamified elements that captured every learner's attention. Many mentioned that the quick feedback and scoring gave more opportunities for the students to notice the gap in their knowledge.

Student #31 explained, *"With the help of AI, the examination was not just focusing on final scores, but it became more efficient and saved time that could be spent on finding the strengths and weaknesses in my English knowledge."*

AI Reduces Teachers' Workload and Teaching Difficulties

Reflective teaching statement

The AI-mediated instruction inspired a passion for students' extra effort and language practice in classrooms. Many of them dedicated more interest and curiosity beyond the classroom setting. As a result, teacher's workload is dramatically reduced.

As teacher # 8 noted, *"I used to hesitate to complete the syllabus of each session, scared of not covering that session's steps. But with the AI platform's support, students exhibit more interest in learning leading to a faster practice and understanding."*

Additionally, teachers could handle their daily work more efficiently. This could allow them to focus more on the teaching process and interacting with learners, resulting in more learning involvement.

Teacher #7 shared, *"AI helped me automatize routine class procedures such as calling the roles, organizing my schedule, and grading assignments. This could save more time to spend on students' other educational needs."*

Observation of Instruction

Many observers reported that owing to the effect of Curipod that could create interactive lesson activities on any topic, teachers could allocate more time to teaching rather than paperwork or lesson planning. They described it as a catalyst that created a great deal of time for the most crucial aspects and steps of doing the tasks in classrooms.

Observer #5 pointed out, *"Teachers were focusing on better presentation of materials, faster transferring of knowledge, deeper students' retention and learning instead of spending time on trivial matters. It is better to say teachers focused on solving problems that engaged students in learning."*

Furthermore, through ChatGPT, the observers highlighted how AI could mediate to manage teaching difficulties through building relationships between teachers and students. The AI by itself was not able to foster this relationship; however, AI could reduce the responsibilities of teachers which led to more time to nurture learners' emotional well-being and social skills.

Observer #2 mentioned, *"Teachers had more time to discuss students' difficulties in learning. This rapport created a sense of intimacy between teachers and students. Therefore, the teachers had a chance of knowing each student's style of learning and providing relevant strategies to improve their English knowledge."*

Student Feedback

Students commented that the AI platforms played a crucial role in producing an environment that lightens teachers' extra workload. They emphasized how the generative AI lent them countenance to take risks and participate actively while the teacher needed assistance in presenting and practicing phases of instruction. This inclusive atmosphere was illustrated as an approach to ease the teaching difficult moments.

Participant #16 shared, *"In my previous English classes, we used to rely on the book instruction and teacher's general guidance to do a task, but now with the help of AI, so many patterns, structures, and sentences are provided for every student's current need."*

Furthermore, the learners attributed their progress to the AI-mediated recognition of their learning style and preferences far better than the teacher simply because the teachers were occupied by the excessive burden of teaching responsibility.

As student #11 stated, *"The AI noticeably shared the teacher's workload. In the past, the teacher had difficulty dealing with and recognizing each student's interests and preferences in practicing, but this new experience changed the way teachers managed students' difficulties in learning a new lesson."*

Discussion

Exploring the opportunities enhancing English language teachers' TPACK, the researchers sought to discover the ways that AI-mediated tools and software could accomplish this objective. In this vein, a three-staged mixed-methods study was conducted to survey EFL teachers' experiences of the phenomenon. The findings, in general, indicated that most English language teachers are willing to implement AI-supported software and tools in their instruction and thus improve teacher-student rapport, learners' motivation, and involvement through customized learning support (Cañada et al., 2014; Ebadi & Amini, 2022; Ghafouri, 2024).

Prior to the study, an overwhelming majority of the participants were against the integration of AI and TPACK. Based on the extracted themes, one of the drawbacks was provoking anxiety and discomfort among teachers which has been supported by several studies (Kaban & Ergül, 2020; Istenic et al., 2021). Dissimilarly, Ayanwale et al. (2022), in their study standing in stark contrast to this theme, reported that anxiety and social status are not reliable indicators of instructors' intention or willingness to use AI in the classroom, even though other factors also affect this aspect of teaching.

Moreover, the issue of distrust and lack of technological knowledge among teachers pressurizes them not to rely on this medium (AI) safely. Such pressures imposed on teachers need to be interpreted in light of individual and cultural vulnerabilities offering unequal services and benefits in their context (Amin, 2023). Regarding these cultural and educational nuances, Amin (2023) suggested that "AI-generated resources [should] meet educational standards and are accurate, up-to-date, and culturally sensitive" (p.11). Additionally, the effective implementation of AI education is determined by teachers' expertise, since the success of the teaching and learning outcomes are akin to the teachers' dominance in exercising AI-mediated instruction in the classroom (Ayanwale et al., 2022). Indeed, Although AI-supportive systems are capable of executing diverse tasks and transforming traditional instructional methods, teachers are noticeably playing a key role in crafting practical lesson plans that line up with curriculum goals. Teachers' lack of knowledge and skills to integrate AI and TPACK in the classroom appears to be inherently unacceptable, thus, language teachers are responsible for including digital literacy into teaching programs to empower learners to foster critical thinking about technology, identify reliable sources from unreliable ones, and hone their skills as language learners.

Following the AI training intervention, the findings revealed that the participants underwent a gradual transformation in their teaching process. Regarding the "assistive role for teachers", AI reshaped and evolved the methods of conducting instruction, generating customized lesson plans that leverage learners' needs and interests. In other words, teachers' roles have been repositioned through AI mediation from a transmitter of knowledge to that of a facilitator (Kim & Kim, 2022). Likewise, through a variety of digital devices, the AI-enabled software offered personalized learning support. These resources could interact with students in the classroom and support their learning.

As indicated above, the use of AI can hone teachers' assessment methods and create a more dynamic and individualized assessment process. Many participants noted that AI-assisted testing obviated several traditional assessment deficiencies such as inadequate testing time duration, testing anxiety, test bias, delayed grading and feedback, and proxy test-taking (Amin, 2023). Given this, teachers can modify their teaching strategies based on the insightful information they receive about students' development via AI-enhanced performance analysis. In general, Sánchez-Prieto et al. (2020) argued that the onus is on educators to incorporate insights produced by AI into their pedagogy. Using this data, they may customize education to meet the needs of each unique student, highlighting areas that need improvement and providing more help when needed (Alavi et al., 2024).

The final theme highlighted in this study concerning the use of AI in language classes was "reducing teachers' workload". In this study, AI-mediated tools and software engage learners in peer learning. Through peer interactions, learners are provided with immediate feedback on practicing various linguistic patterns resulting in active personalized support and reducing the administrative load on teachers (Bigverdi, & Khalili Sabet ; Hashem et al., 2023). Another important aspect of integrating AI and TPACK would be assistance in lesson planning which tackles teacher stress and pressure of teaching workload (Waddell 2023). EFL teachers' preoccupation with generating an effective lesson plan that corresponds precisely to the curriculum goals resulted in crafting tailored lesson plans for all types of students. These lesson plans not only boost learners' motivation but enable teachers to allocate their time to other fundamental aspects of instruction.

In this study, the primary focus pertained to the potential impact of AI-assisted tools on the technological proficiency of English language educators. According to the integrative view of TPACK components, the attainment of high TPACK proficiency is contingent upon elevated levels of TPK, TCK, TK, CK, and PK (Schmid et al., 2020). These components serve to enable English language educators to identify technology tools and language applications that are pertinent to English

instruction, thereby providing ample support for the efficient utilization of technology. For example, by enhancing their TPK, English language teachers were able to effectively select and utilize appropriate technological resources and tools that align with curriculum material, learning objectives, and students' needs and interests. Furthermore, through the promotion of TCK, teachers were able to identify how the integration of technology can modify subject matter (Ng et al., 2023). Thus, the present study sought to explicate the potential of AI-assisted roles in overcoming teaching and learning challenges and the application of these tools and resources for pedagogical and content-related purposes.

Conclusion

This study explored English language teachers' experience of AI's transformative role in ELT in Iran. The purpose was to perceive the way that AI-enabled supportive systems could enhance the Language teachers' TPACK. The study challenges the accepted traditional methods followed by EFL teachers to organize their classroom procedures and lesson plans as a certain approach to teaching. Conventional and long-established approaches to teaching should not be the only one strategy in language instruction, rather establishing the opportunity to implement AI-mediated tools and software in English language classes should be high on the academic agenda. In general, the findings might be related to the effectiveness and efficiency of the AI-enabled systems in providing EFL teachers with essential information that enhances their TPACK knowledge. Research practice needs to be started, conducted, and finished as a collaborative investigation by individuals who either substantially contribute to or carry out certain aspects of the research project.

The findings underscore the importance of encouraging AI-mediated instruction among educators as they navigate the complexities of language teaching. AI tools have the potential to enhance teachers' competencies across all TPACK domains, including technological, pedagogical, and content knowledge. For instance, the integration of AI can support more communicative and personalized learning experiences. Furthermore, educational institutions may consider developing training programs that focus on the incorporation of AI within the TPACK framework, thereby equipping teachers with essential AI skills for English language teaching.

Policymakers could develop policies that encourage the use of AI in teacher education programs. This research was partly successful in underscoring the significance of AI literacy for educators. As a result, benchmarks could be created to emphasize and assist in the integration of AI into classroom teaching practices.

This research has the potential to open up new avenues for exploring how educational inequalities can be exacerbated if well-resourced and under-resourced schools lack access to AI tools. Consequently, when AI enhances TPACK for English language teachers, both educators and learners may experience increased confidence and proficiency in integrating technology into their teaching methods, which could help bridge the gap among different students.

Notwithstanding its contribution, it is imperative to acknowledge that this study exposes several inherent limitations that should be taken into consideration when rendering the results. Firstly, this mixed-methods investigation was carried out in a controlled educational environment, with a particular emphasis on purposive sampling and the recruitment of a particular group of EFL teachers from a single city. This is an important point to note. As such, care needs to be taken when extending the results to larger contexts for language learning and teachers with greater diversity. Future research projects should aim to include a more diverse and representative sample of EFL teachers to improve trustworthiness, rigor, and credibility. This would enable the results' robustness and applicability to be verified and expanded across a range of educational contexts.

Moreover, due to the temporal limits of the research, the study's focus was limited to the immediate consequences of AI-mediated training. The execution of long-term follow-up research is obviously necessary to achieve a more thorough and holistic understanding of the phenomenon. Assessing the sustainability of the noted elements of TPACK such as PK, TK, and CK would be made easier by these longer investigations. Investigating the long-term effectiveness of AI-powered language

training and its possible consequences for long-term language learning outcomes will yield a wealth of information, the results of which would be invaluable.

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Appendices

Appendix A: Table of observation fieldnotes

| | | | | | | |
|---|-----------------------|---|-----------------------------|-----------------------------|--|--|
| 1 | The learner | What learners do | What motivates the learners | What involves the learners | The effect of teacher's reaction on the learner | |
| 2 | Presenting the lesson | Teacher's strategies | Learner's participation | Teacher's feedback | | |
| 3 | Learning aims | Teacher's aim | Were the aims achieved? | | | |
| 4 | Task process | Was the application of AI relevant to the Task? | Teacher's role | Learner's role | Was the application of AI support system successful? | |
| 5 | Assessment process | What did the teacher test? | How was it tested? | How did the student answer? | What was the role of AI in the testing process? | |