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Integrating chatbot technology in language teacher education: A TPACK-based analysis of pre-service teachers' professional development

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Abstract

As many EFL countries introduce digital textbooks and AI-based language education, the importance of enhancing pre-service language teachers' Technological Pedagogical Content Knowledge (TPACK) in language teacher education is increasingly being emphasized. This qualitative case study examined how 13 pre-service English teachers applied various elements of TPACK through their participation in a chatbot-integrated course designed to provide hands-on, design-based experience. Analysis of participants' weekly reflection journals revealed their evolving engagement with TPACK elements, Design Knowledge, and contextual considerations. As the semester progressed, the pre-service English teachers demonstrated enhanced TPACK contribution through their growing capacity to integrate technology in language instruction and deeper understanding of pedagogical implications. The pre-service teachers were also able to better combine chatbot and language teaching and became more confident in situating themselves as effective English teachers through the course. The study provides a comprehensive TPACK-based framework for language teacher educators to evaluate and develop pre-service teachers' technological, pedagogical, and content competencies in technology-enhanced instruction. These findings offer practical implications for language teacher educators seeking to incorporate TPACK-informed approaches in their course design and professional development programs.

Keywords: *Pre-service Teacher training*; *EFL*; *TPACK*; *Technology-enhanced Language Instruction*

Language(s) Learned in This Study: *English*

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Introduction

Pre-service teacher education serves as an important role to develop teachers' instructional capacities and to enhance their self-efficacy in using digital technology (Lemon & Garvis, 2016). In addition, the uptake and use of technology in education can empower pre-service teachers to develop innovative and localized practices that are attuned to students' various needs and address local linguistic and sociocultural contexts in which teaching takes place (McNeil, 2018). It is thus important for pre-service teachers to have a technology-integrated course in their content areas rather than merely taking educational technology courses in isolation because technology in education is "not an add-on but rather integral to teaching performance" (Koehler et al. 2011, p. 151).

With many English-as-a foreign language (EFL) countries introducing digital textbooks and emphasizing AI-based language education, the importance of increasing pre-service teachers' Technological Pedagogical Content Knowledge (TPACK) and technology-integrated teacher education is increasingly being emphasized (Celik, 2023; Yue et al., 2024, among many). Research has shown that merely

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introducing new technologies without developing teachers' integrated knowledge of technology, pedagogy and content often leads to ineffective implementation of digital technologies that fails to enhance language learning outcomes (Ji et al., 2023; Pokrivcakova, 2019). While chatbots offer promising advantages for language learning through personalized interaction and immediate feedback (Huang et al., 2022; Kim et al., 2021; Liu & Reinders, 2025), their effective implementation requires teachers' professional understanding of both technological capabilities and pedagogical knowledge. It is thus important to provide both in-service and pre-service teachers with sufficient opportunities and training through which they not only understand the technology skills but also develop integrated knowledge of technology, pedagogy, and content (Choi, 2024; Moorehouse & Kohnke, 2024).

Using the TPACK framework proposed by Koehler and Mishra (2005), this study aims to qualitatively explore how 13 pre-service English teachers apply various elements of TPACK through their participation in a chatbot-integrated course designed to provide hands-on, design-based experiences. In particular, the study examines which TPACK elements pre-service teachers prioritize while learning to use chatbot technology and how they apply these elements in designing their own AI chatbots for language instruction. By focusing on the design process, this study addresses a critical gap in our understanding of how pre-service teachers develop the complex knowledge needed to effectively integrate AI technologies, particularly chatbots, into language instruction. The findings of the study provide a comprehensive TPACK-based framework for language teacher educators to evaluate and develop pre-service teachers' technological, pedagogical, and content competencies in technology-enhanced instruction. These findings offer practical implications for language teacher educators who try to incorporate TPACK-informed approaches in their courses and professional development programs.

Literature Review

Technological Pedagogical Content Knowledge (TPACK)

With the advancement of technology, the integration of digital technology in teaching has become one of the most important aspects of the field of language teaching and learning. While many teacher education programs now include technology courses, they often teach technology skills separately rather than integrating them into teaching practice (Koehler et al., 2013). Teaching technology skills in isolation, however, fail to prepare teachers to develop integrated knowledge of technology, pedagogy, and content that would enable them to implement technology effectively in their teaching practices (Sun et al. 2017). To address this challenge, Koehler and Mishra (2005) introduced the Technological Pedagogical Content Knowledge (TPACK) framework as a more integrated approach for capturing the complex interplay between technology, pedagogy, and content. The TPACK framework builds on Shulman's (1986) concept of Pedagogical Content Knowledge (PCK) by integrating technological knowledge as one of the main components of effective technology-integrated teaching.

The TPACK framework is built on three core areas: pedagogical knowledge (PK), content knowledge (CK), and technological knowledge (TK). It also includes combinations of these core areas. Pedagogical content knowledge (PCK) involves understanding how to teach a specific subject. Technological pedagogical knowledge (TPK) is knowing how to use technology in teaching. Technological content knowledge (TCK) is understanding how technology can be used to represent subject matter in new ways. Lastly, TPACK includes the ability to effectively integrate technology into teaching while considering both subject matter and teaching methods.

The TPACK framework has been widely used to analyze pre-service teachers' development of technology use and design and has further been expanded to include pre-service teachers' knowledge of Design Knowledge (DK) and Context (C). For example, Nguyen et al. (2022) included DK and C in their analysis of pre-service teachers' technology mediated lessons. DK is related to the design strategies that pre-service teachers use to decide on design goals, aesthetic options, and task delegation. C is relevant to the consideration of the teaching and learning context. They found that DK was the primary focus of the

participants' conversations and that CK was predominant in the earlier stages, but later, the focus shifted to DK. They suggested emphasizing DK in addition to TPACK to assist pre-service teachers in better integrating their existing knowledge with technology.

Although TPACK has been widely adopted in educational technology research (Tseng et al., 2022), little is known about its application to language teaching, particularly in the context of emerging AI technologies. While previous studies have examined TPACK in language education (e.g., Cheng, 2017; Liu & Kleinsasser, 2015; Tseng et al., 2019), there is limited research on how language teachers develop and apply TPACK when integrating AI technologies into their teaching practice (e.g., Lee & Jeon, 2024). This gap is particularly significant given the rapid advancement of AI technologies and their potential impact on language teaching practices. The present study addresses this gap by examining how pre-service language teachers develop and apply TPACK while integrating AI chatbot technology within their teaching practice.

Chatbot Technology

Chatbots have been developed for and introduced to the field of language learning since the early 2020s and have gained much attention because they can be programmed to mimic authentic human conversations, which can offer learners practice opportunities (Kim et al., 2021; Shin & Lee, 2024). Research has shown that chatbots offer opportunities to learners to use authentic language, making chatbots useful and practical supplements to learning (Shadiev & Feng, 2024). Additionally, pre-developed chatbots, including "Ellie" (Kim et al., 2022) and "Lucy" (Wang & Petrina, 2013), have shown their potential as L2 practice tools. More recent advancements in the field of chatbots have opened doors for users with limited or no computer programming experience to design their own customized chatbots due to the development of platforms such as *Chatfuel*. These platforms have been widely used in research to develop user-focused L2 learning tasks to target specific speech acts (e.g., Kim, 2024a; Kohnke, 2023). Still, these chatbots have mostly been developed by language teachers or researchers to be used as supplementary learning materials to facilitate out-of-class learning.

Because recent technological development in chatbots allow non-professionals in programming to develop their own chatbots for various purposes, the process of developing chatbots for L2 learning can offer pre-service teachers opportunities to integrate their developing subject matter content knowledge with technological knowledge. Shin and Lee (2024) investigated applying LLM (large language model)-based chatbots to the field of pre-service teacher education because LLM-based chatbots are comparatively easier to develop vis à vis developing chatbots on platforms like *Chatfuel*, as they remove the need to create pre-determined utterances and expressions. Their research, which primarily focused on pre-service teachers' perceptions of their experiences using LLM-based chatbots on different chatbot-building platforms, found that pre-service teachers' experiences using the platforms were positive and that the participants reported they believed that LLM-based chatbots have the potential to be useful in L2 classrooms. However, since L2 education usually follows educational standards and mandates to regulate for difficulty, topic, and range in vocabulary and grammar, it is necessary to create chatbots that meet educational mandates and students' levels of proficiency in their target L2 instead of using LLM-based chatbots or off-the-shelf chatbots. Therefore, to address such a gap in the research, the present study investigated the TPACK elements that pre-service English teachers concentrate on and prioritize while developing chatbots for L2 learners using *Chatfuel* in a technology-infused language teaching course. Through hands-on experience with *Chatfuel*, pre-service English teachers learn to create tailor-made customized chatbots that align with their specific curriculum objectives and student needs. In particular, the present study addresses the following research question:

How do pre-service EFL teachers focus on elements of TPACK, Design Knowledge (DK), and Context (C) while designing text-based chatbots for language learning?

By analyzing pre-service teachers' chatbot development processes, this study aims to identify essential technological and pedagogical support needed to enhance their TPACK development. The findings will provide teacher educators with practical insights into designing effective scaffolding strategies for preparing pre-service teachers to integrate AI technology into language teaching.

Method

Research Context and Course Description

The study was conducted at a pre-service English teacher education program in a private university located in Seoul, the capital of South Korea. As the South Korean government began introducing chatbot technology as an effective language learning tool and encouraged its use in public schools, the English teacher education program where the study was conducted began to incorporate chatbot technology into its programs. In 2022 and 2023, the program offered three-hour chatbot workshops led by the second author each semester to enhance pre-service teachers' knowledge of chatbot technology. Based on feedback from participating pre-service teachers in 2022 and 2023, we, as a team of professional teacher educators, developed a chatbot technology-integrated teacher education course. While the first and third authors—both teacher educators specializing in English education—participated in designing the course, the second author, an in-service English teacher and Ph.D. holder specializing in chatbot use in English education, also contributed to the course design while serving as the instructor.

The objective of the chatbot technology-integrated course is to equip pre-service English teachers with a comprehensive understanding of second language acquisition within the framework of AI chatbot, technology-infused language learning. Throughout the semester, pre-service teachers learned foundational SLA theories essential for AI-based language learning and were guided in designing and creating their own practical AI chatbot for English language learning (see Table 1 for course schedule).

Table 1

Course Schedule

Phase	Instructional goal
Phase 1: week 1-8	Concept & Overview - Learning the major concepts and theories related to AI technology-infused language learning - Observing the use of AI-technology infused classroom activities (6 hours) - Learning and practicing how to use *Chatfuel* (12 hours) - Creating an outline of their own chatbot for language learning, including its targeted language forms/functions and its main character and storyline - Engaging in a feedback session with peers and the instructor
Phase 2: week 9-11	Technology in use - Creating their own chatbot using *Chatfuel* - Having a troubleshooting/feedback session with the instructor (8 hours) - Engaging in a feedback session with peers
Phase 3: week 12-15	Launching & sharing - Sharing their own chatbot in class and engaging in peer evaluation - Writing a self-reflection paper on their overall experiences

Participants

The participants included 13 South Korean pre-service teachers majoring in English education at the time of data collection. All were seniors who took a chatbot technology-integrated course in Fall 2023. All participants completed the required four-week teaching practicum during the previous semester, as well as 60 hours of volunteer teaching. While they had taken a basic educational technology course, none had experience in using digital tools for language teaching material development or creating digital learning materials for instructional purposes. All the participants voluntarily participated in the research, and they were informed that their (non)participation did not influence their final grade.

Chatbot Technology: *Chatfuel*

Pre-service teachers used *Chatfuel*, a popular platform for building text-based chatbots on messaging platforms, such as Facebook Messenger and Instagram Direct Messages, to create instructional digital learning materials. *Chatfuel* is a user-friendly platform that allows pre-service teachers to create interactive chatbots without coding or programming. *Chatfuel* allows users to map out conversations by using a drag-and-drop flow builder to help visualize the conservation without coding. *Chatfuel* is widely used in business and marketing for customer service purposes and has also been recently used in language learning research (e.g., Kim, 2024a). Figure 1 shows a sample *Chatfuel* flow builder.

Figure 1

Sample Chatfuel Flow Builder

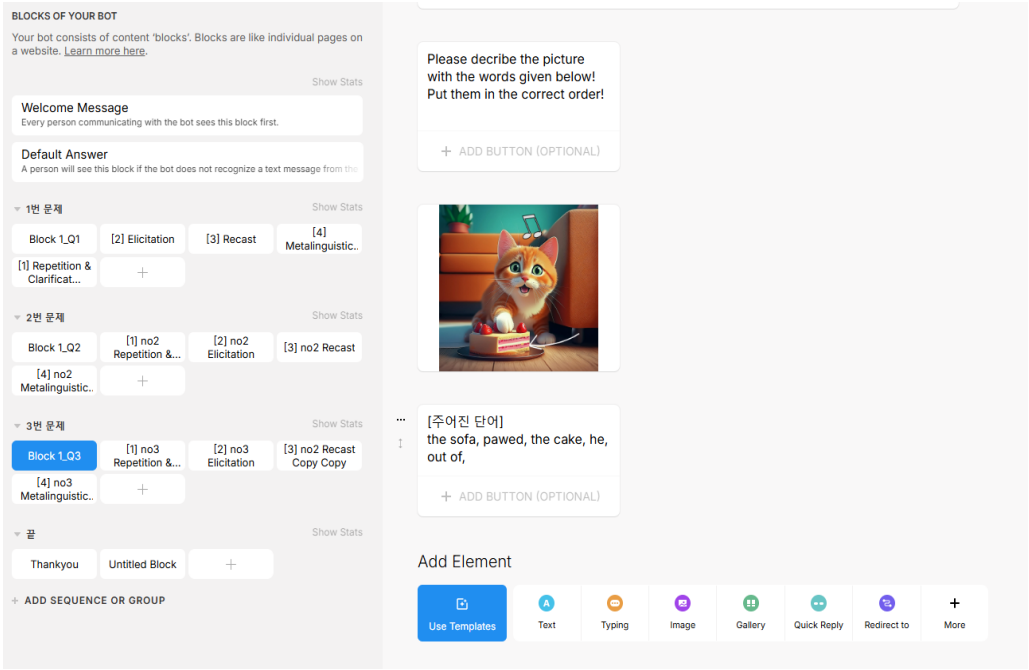
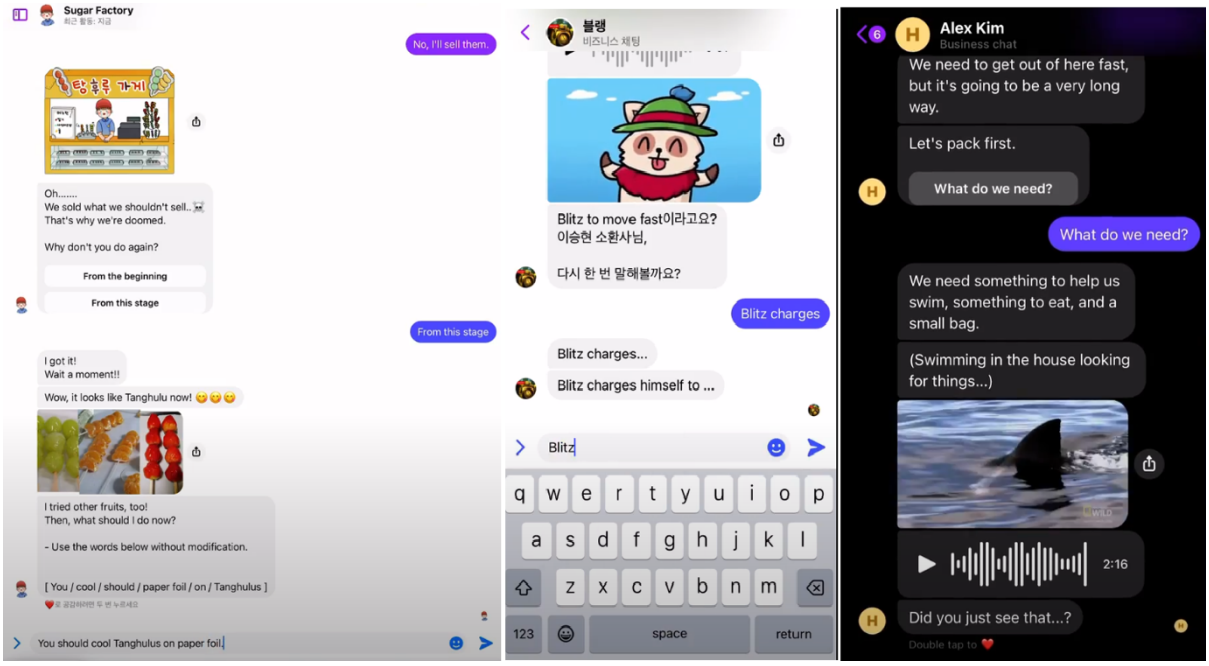


Figure 2 shows chatbots that were created by pre-service English teachers in the current study using *Chatfuel*. The pre-service teachers first analyzed their assigned English lessons to design pedagogically sound language learning activities incorporating chatbots. Based on their instructional objectives, they developed appropriate chatbot storylines, determined feedback types to support student learning, created necessary images, and implemented their designs using the *Chatfuel* platform.

Figure 2

Chatbots Created by Participants Using Chatfuel



Instruments, Data Collection and Analysis

We used a case study approach (Miles & Huberman, 1994) to collect qualitative data to explore the knowledge elements that pre-service English teachers focus on and prioritize while designing their own chatbot for language learning during the course of the semester. Data included weekly reflection journals in which participants discussed their overall experience with or perceptions of AI chatbot technology, as well as challenges or concerns encountered while designing and creating their own chatbots for language learning. We collected one hundred and fifty-six entries of weekly reflection journals. We also collected their project, which included an initial plan, a tentative outline, and the final outcome of their chatbot.

We analyzed the qualitative data using the thematic analysis process. We followed Braun and Clarke's (2006) six-phased procedures: (a) familiarizing ourselves with the data, (b) coding, (c) identifying initial themes, (d) reviewing themes, (e) identifying overarching themes and categories, and (f) producing the report. The initial coding was done based on the coding framework introduced by Nguyen et al. (2022), which allows us to closely analyze different knowledge elements related to the TPACK framework, DK, and C (see Table 2, refer to Table 3 for exemplary student excerpts for each coded unit). We first individually sorted and analyzed the data using the initial coding framework. We then collectively discussed and reviewed themes. Throughout the thematic analysis process, we cross-referenced themes with the data and actively searched for contradictory or supporting examples to increase the integrity and quality of the analysis.

Table 2

The Main Coding Framework

	Main codes	Definitions
1.	Technological Knowledge (TK)	Reflections/discussion related to the use of chatbot technology
2.	Pedagogical Knowledge (PK)	Reflections/discussion related to the use of pedagogical strategies and approaches
3.	Content Knowledge (CK)	Reflections/discussion related to second language (L2) learning
4.	Pedagogical Content Knowledge (PCK)	Reflections/discussion related to L2 learning pedagogies that do not include the use of chatbot technology
5.	Technological Pedagogical Knowledge (TPK)	Reflections/discussion related to how chatbot technology can be used to support particular pedagogies
6.	Technological Content Knowledge (TCK)	Reflections/discussion related to the use of chatbot technology for content representation
7.	Technological Pedagogical Content Knowledge (TPACK)	Reflections/discussion related to how chatbot technology can be used to support particular L2 pedagogies
8.	Design Knowledge (DK)	Reflections/discussion related to the designing process
9.	Context (C)	Reflections/discussion related to context-related issues such as a school setting

Table 3

Exemplary Student Excerpt for Each Main Code

	Main codes	Exemplary student excerpt
1.	TK	*What impressed me the most was the typing function, which could provide a slight delay as if an actual person was typing. A 'chatbot' does not need such a delay at all, but it was interesting that such a function was added solely to implement a sense of realism.* *My initial experience with Chatfuel was a pleasant surprise. The block-coding format was very intuitive.*
2.	PK	*A student-centered approach emphasizes active learning. By creating engaging learning experiences, teachers can motivate students to take ownership of their learning and deepen their understanding.* *To create engaging and effective classes, it is essential to prioritize students' needs and interests. By designing classes that align with their own goals and expectations, teachers can offer students a more motivating and rewarding learning experience.*

3.	CK	*The target language was designed to challenge Korean learners by incorporating complex sentence structures, including type 4 and type 5 sentences, as well as sentences using phrasal verbs. These linguistic elements are often sources of difficulty for Korean students.* *In Korean, "happy" is commonly used as an adverb to modify the verb "to look." However, English grammar dictates that "happy" should be used as an adjective in this context, directly describing the subject's emotional state.*
4.	PCK	*As Schmidt's (1983) study shows, even with high motivation and ample exposure, a solid foundation in grammar and syntax is crucial for effective language production. Even motivated learners with sufficient input may encounter difficulties in expressing themselves using a target language if they lack a firm understanding of these fundamental linguistic elements.*
5.	TPK	*Chatbots equipped with computer adaptive testing technology could provide a more effective means of diagnosing students' varying language proficiencies.* *Integrating chatbot activities into TBLT classrooms could provide teachers and students with ample opportunities regarding where a target language may authentically be used.*
6.	TCK	*No matter how much artificial intelligence technology develops, it is difficult for AI to fully use language that indicates emotions and culture.* *The NP+PP structure, frequently observed in telegraphic speech, is often a stumbling block for Korean students. I believe that a chatbot could be a beneficial supplement for helping learners to overcome this difficulty.*
7.	TPACK	*By incorporating the textbook's learning objectives into the chatbot's review points, we can create a more versatile and effective tool. This would allow teachers to easily create chatbots that are closely aligned with their classroom instruction. I believe teachers could develop comprehensive review chatbots for each textbook, providing students with a valuable resource for reinforcement and practice.* *When designing the chatbot, I found that the optimal sequence of feedback for learner responses was crucial. The three questions that involve type 4 sentences employ different feedback strategies. The first question primarily provides implicit feedback for errors, while the second offers explicit guidance. The final question introduces a requirement to replicate the previous question's structure, aiming to solidify the learner's mastery of type 4 sentences.*

8.	DK	*My older sister, a media content studies major, offered valuable insights into chatbot design, emphasizing the importance of visual appeal. She stressed the importance of having a visually appealing presentation when designing the chatbot.*
		In this class, I have set up the first problem, but it took longer than expected. Since I have a grasp of the chatbot configuration this time, I believe I will be able to do the following tasks easily.
9.	C	*With class sizes often reaching 30 students, many schools struggle to implement individualized learning approaches, as students' achievement levels can vary widely.*
		Electronic devices, including smartphones, are frequently used in public schools.

Findings

Table 4 shows the frequency distributions of coded units across seven TPACK constructs, DK, and C categories, as analyzed in three phases.

Table 4

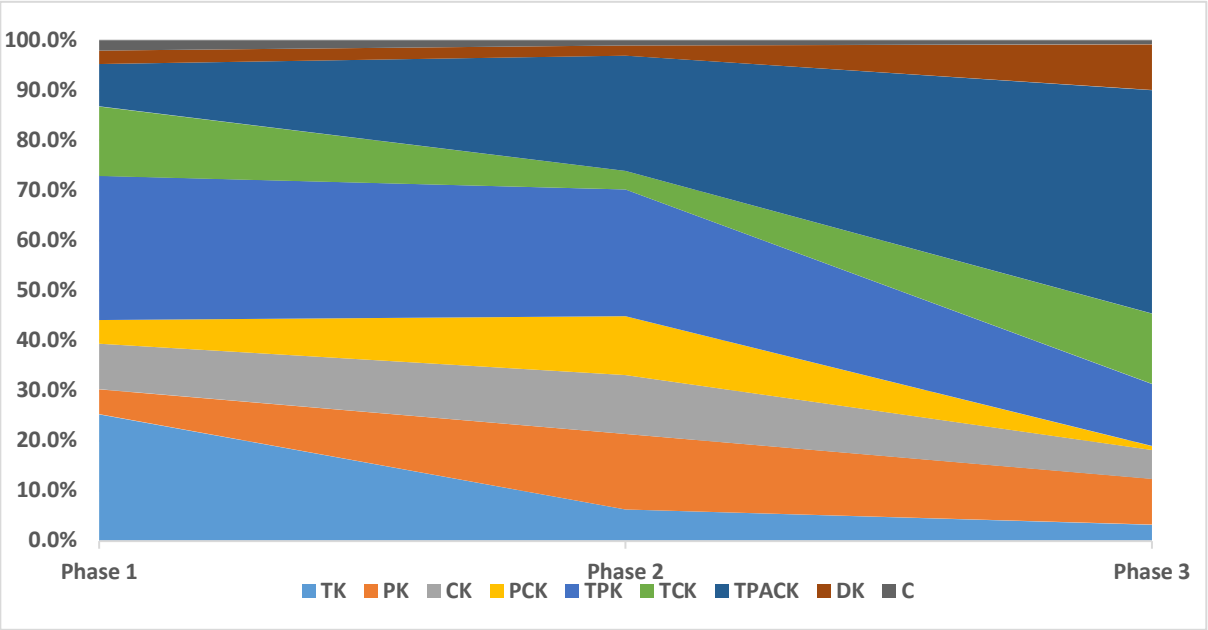
Distribution of Coded Units by Phase

	Phase 1	Phase 2	Phase 3
TK	25.3%	6.4%	3.3%
PK	5.0%	15.1%	9.1%
CK	9.1%	11.7%	5.8%
PCK	4.7%	11.7%	0.8%
TPK	28.8%	25.3%	12.4%
TCK	13.8%	3.8%	14.0%
TPACK	8.5%	23.0%	44.6%
DK	2.6%	2.0%	9.1%
C	2.1%	1.0%	0.8%

In Phase 1, as shown in Figure 3, pre-service teachers' reflections predominantly focused on TK and TPK, constituting nearly 54% of the coded units. TPACK, TCK, and CK were less frequently addressed by pre-service teachers in Phase 1, with each coded unit comprising approximately 10% of the coded units. The predominance of TK and TPK in Phase 1 indicates that pre-service teachers primarily focused on technological and pedagogical aspects of teaching while learning various theories and concepts related to AI technology-infused language learning and developing their own chatbot outline. Notably, DK and C received little attention during this phase, accounting for only 2.6% and 2.1% of reflections respectively. This indicates that pre-service teachers were not yet substantially engaging with design principles or contextual considerations for their chatbots in the initial phase.

Figure 3

Stacked Percentage Distribution of Coded Units by Phase



As pre-service teachers progressed to Phase 2, their focus shifted toward integrating technological and pedagogical knowledge in language teaching contexts, with TPK and TPACK emerging as dominant elements (25.3% and 23.0% respectively). Comparing the distribution of coded units in Phase 1 and Phase 2, TPK remained a consistent presence throughout the two phases, while TK significantly declined, from 25.3% to 6.4%, and TPACK notably increased from 8.5% to 23.0%. The significant increase in coded units TPACK and TPK during Phase 2 suggests that pre-service teachers largely focused on integrating technology into subject-specific teaching while developing their own chatbots by using *Chatfuel*. This shift from technological considerations to their pedagogical applications suggests that pre-service teachers started to explore how to effectively and yet meaningfully incorporate chatbots into language teaching. In this phase, DK remained relatively low at 2.0%, while context-related reflections decreased to 1.0%. This suggests that pre-service teachers were still primarily focused on general technology integration rather than specific design considerations or contextual factors in their chatbot design.

Phase 3 showed a significant shift in pre-service teachers' approach to their chatbot design, with TPACK becoming the primary focus of pre-service teachers' reflections, accounting for 44.6% of the total coded units. A steady increase in TPACK was evident among pre-service teachers' reflections. As shown in Table 4, TPACK largely increased, from 8.5% in Phase 1 to 23.0% in Phase 2 and 44.6% in Phase 3. The strong emphasis on TPACK during Phase 3 suggests that pre-service teachers focused more on how to integrate technology into their content areas while sharing their own chatbots, participating in peer evaluation, and reflecting on their overall experiences. In contrast to Phases 1 and 2, DK showed a substantial increase in Phase 3, rising from 2.6% to 9.1%. This increased attention to DK suggests that pre-service teachers began more actively considering design principles and elements as they refined their own chatbots.

The dramatic increase in these TPACK-related reflections indicates that pre-service teachers developed a more sophisticated understanding of how to integrate chatbot technology specifically for language teaching purposes. While context-related considerations remained relatively low throughout all phases,

the simultaneous growth in TPACK and DK during Phase 3 suggests that pre-service teachers developed a more comprehensive understanding of how to design and implement chatbots for language learning.

Discussion

The findings of this study illuminate pre-service English teachers' developmental trajectory while participating in a chatbot technology-integrated course designed to provide hands-on, design-based experiences. The initial dominance of TK and TPK in Phase 1 aligns with previous research that shows language teachers often focus on basic technological competencies and skills when first encountering new digital technologies (Hughes, 2005; Koehler & Mishra, 2005). This finding highlights the importance of providing proper supports and training for teachers to develop technology skills before considering technology integration in language teaching.

The significant shift toward TPACK in Phases 2 and 3 (from 8.5% to 44.6%) demonstrates the growing ability of pre-service English language teachers to integrate technological, pedagogical, and content knowledge in their chatbot designs. This shift underscores the importance of scaffolding pre-service teachers' integration of technological, pedagogical, and content knowledge. Some examples of such scaffolding include providing pre-service teachers opportunities to analyze exemplary chatbots designed for language learning, engaging in feedback sessions where they explicitly discuss how their chatbot design aligns with language teaching objectives and goals, and conducting peer evaluation sessions that provide them with a chance to scaffold each other's chatbot design.

However, the consistently low attention to context (C) across all phases raises important questions about how to better support pre-service teachers in considering contextual factors when integrating technologies into their practice. Considering contextual information is crucial in providing localized instruction that reflects the unique needs of individual students and institutions (Johnson, 2009). To address this shortcoming, teacher educators need to implement more explicit strategies to help pre-service teachers consider diverse learning environments, student backgrounds, technological accessibility, and sociocultural factors while implementing AI technologies, including chatbot technology, in their teaching practice (c.f., Choi & Chung, 2021). Teacher educators could address this gap by incorporating case studies of language learning in different contexts, requiring pre-service teachers to incorporate specific contextual needs addressed by a certain case, and engaging them in scenario-based planning that considers various contextual constraints and opportunities.

It is noteworthy that the findings of this study demonstrate a significant increase in TPACK enactment among pre-service teachers, while previous studies often have reported less evidence of TPACK growth in pre- and in-service teachers. Several factors can be attributed to the significant TPACK improvement among pre-service English teachers which was not observed in previous studies (Nguyen et al., 2022). First, the chatbot technology-integrated course offered sufficient opportunities for instructors to engage in hands-on experiences related to technology integration and workshops, fostering a deeper understanding of how to effectively incorporate technology into their teaching (Koh et al., 2015; Schimd et al., 2021). Second, the learning technology by design approach that is facilitated by the course enables pre-service teachers to actively explore and understand effective technology integration in their specific areas of teaching. By adopting the Koehler and Mishra (2005) framework, the chatbot technology-integrated course provides various opportunities for pre-service teachers to engage in solving authentic problems, a process that underscores the complexity of the learning context and (re)designing of chatbots. Third, many participating teachers, as digital natives, are already familiar with chatbot technology and its potential applications, which renders them more receptive to its use in their own teaching practices. This aligns with Kim's (2024b) recent research in which he finds that South Korean pre-service English teachers generally have a positive attitude about AI-based technologies and are eager to explore the pedagogical potential of that technology. Similarly, the significant increase in TPACK shown in this study may have contributed to pre-service teachers' positive feelings about AI-technology, as could have their prior experiences related to AI technology, including chatbot technology.

Conclusion

In conclusion, the findings of this study demonstrate the effectiveness of a chatbot-integrated course in enhancing pre-service English teachers' TPACK focus. Some limitations of the study should be addressed. First, the study observed only one case of a chatbot-integrated course for pre-service teachers and did not include an experimental study of the effects of the course. It may be difficult to suggest that pre-service teachers in a chatbot-integrated course demonstrate an advantage in developing their TPACK. An experimental study that examines its effectiveness by comparing pre-service teachers' development using different types of technology can offer a more in-depth understanding of how varying types of technology can influence the participants. Furthermore, due to the small number of participants in the current case study, it may be necessary to expand the scope of the study by including more pre-service teachers who have different educational experiences and interests. Such an approach would further our understanding of pre-service teachers' needs.

The significant increase in TPACK enactment observed in this study highlights the importance of providing both pre-service and in-service teachers with comprehensive training programs that emphasize hands-on, design-based experiences related to technology integration in their teaching practices. Furthermore, the study's findings suggest that teachers' familiarity with and positive attitudes regarding AI-based technologies can play an important role in their willingness and ability to effectively integrate technology into their teaching.

References

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Celik, I. (2023). Towards Intelligent-TPACK: An empirical study on teachers' professional knowledge to ethically integrate artificial intelligence (AI)-based tools into education. *Computers in Human Behavior*, *138*, Article 107468. https://doi.org/10.1016/j.chb.2022.107468

Cheng, K.-H. (2017). A survey of native language teachers' technological pedagogical and content knowledge (TPACK) in Taiwan. *Computer Assisted Language Learning*, *30*(7), 692–708. https://doi.org/10.1080/09588221.2017.1349805

Choi, L. (2024). Pre-service English teachers' beliefs and practices in the use of digital technology: the case of a technology-enhanced teacher preparation course in South Korea. *Innovation in Language Learning & Teaching*. Advance online publication. https://doi.org/10.1080/17501229.2024.2355303

Choi, L., & Chung, S. (2021). Navigating online language teaching in uncertain times: Challenges and strategies of EFL educators in creating a sustainable technology-mediated language learning environment. *Sustainability*, *13*(14), Article 7664. https://doi.org/10.3390/su13147664

Huang, W., Hew, K. F., & Fryer, L. K. (2022). Chatbots for language learning—Are they really useful? A systematic review of chatbot-supported language learning. *Journal of Computer Assisted Learning*, *38*(1), 237–257. https://doi.org/10.1111/jcal.12610

Hughes, J. (2005). The role of teacher knowledge and learning experiences in forming technology-integrated pedagogy. *Journal of Technology & Teacher Education*, *13*(2), 277–302. https://brown ingmedportfolio.weebly.com/uploads/2/3/8/1/23811553/hughes_2005_tech-integrated_pedagogy.pdf

Ji, H., Han, I., & Ko, Y. (2023). A systematic review of conversational AI in language education: focusing on the collaboration with human teachers. *Journal of Research on Technology in Education*, *55*(1), 48–63. https://doi.org/10.1080/15391523.2022.2142873

Johnson, K. E. (2009). *Second language teacher education: A sociocultural perspective*. Routledge.

Kim, H.-S., Cha, Y., & Kim, N. Y. (2021). Effects of AI chatbots on EFL students' communication skills. *Korean Journal of English Language and Linguistics*, *21*, 712–734. https://doi.org/10.15738/kjell.21..202108.712

Kim, H., Yang, H., Shin, D., & Lee. J. H. (2022). Design principles and architecture of a second language learning chatbot. *Language Learning & Technology*, *26*(1), 1–18. http://hdl.handle.net/10125/73463

Kim, R. (2024a). Effects of learner uptake following automatic corrective recast from artificial intelligence chatbots on the learning of English caused-motion construction. *Language Learning & Technology*, *28*(2), 109–133. https://hdl.handle.net/10125/73574

Kim, R. (2024b). *How to teach presentation, sentence production and reading in English: Designing instructional model with the use of generative AI and chatbot and their instructional effects* [Conference presentation]. Modern English Education Society (MEESO) 2024 Conference, Seoul, South Korea.

Koehler, M. J., & Mishra, P. (2005). What happens when teachers design educational technology? The development of technological pedagogical content knowledge. *Journal of Educational Computing Research*, *32* (2), 131–152. https://doi.org/10.2190/0EW7-01WB-BKHL-QDYV

Koehler, M. J., Mishra, P., Bouck, E. C., DeSchryver, M., Kereluik, K., Shin, T. S., & Wolf, L. G. (2011). Deep-play: developing TPACK for 21st century teachers. *International Journal of Learning Technology*, *6*(2). https://doi.org/10.1504/IJLT.2011.042646

Koehler, M. J., Mishra, P., & Cain, W. (2013). What is technology pedagogical content knowledge (TPACK)? *The Journal of Education*, *193*(3), 13–19. https://doi.org/10.1177/002205741319300303

Koh, J. H. L., Chai, C. S., Hong, H.-Y., & Tsai, C.-C. (2015). A survey to examine teachers' perceptions of design dispositions, lesson design practices, and their relationships with technological pedagogical content knowledge (TPACK). *Asia-Pacific Journal of Teacher Education*, *43*(5), 378–391. https://doi.org/10.1080/1359866X.2014.941280

Kohnke, L. (2023). A pedagogical chatbot: A supplemental language learning tool. *RELC Journal*, *54*(3), 828–838. https://doi.org/10.1177/00336882211067054

Lee, S., & Jeon, J. (2024). Enhancing pre-service EFL teachers' TPACK through chatbot-integrated lesson planning projects. *Language Learning & Technology*, *28*(1), 1–20. https://hdl.handle.net/10125/73598

Lemon, N., & Garvis, S. (2016). Pre-service teacher self-efficacy in digital technology. *Teachers and Teaching: Theory and Practice*, *22*(3), 387–408. https://doi.org/10.1080/13540602.2015.1058594

Liu, M.-H., & Kleinsasser, R. C. (2015). Exploring EFL teachers' CALL knowledge and competencies: In-service program perspectives. *Language Learning & Technology*, *19*(1), 119–138. http://dx.doi.org/10125/44405

Liu, M., & Reinders, H. (2025). Do AI chatbots impact motivation? Insights from a preliminary longitudinal study. *System, 128*, Article 103544. https://doi.org/10.1016/j.system.2024.103544

McNeil, L. (2018). Introducing teachers to digital game-enhanced pedagogy: Successes and challenges in a graduate course. *TESOL Journal*, *9*(3), 580–584. https://doi.org/10.1002/tesj.383

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook* (2nd ed.). SAGE Publications.

Moorhouse, B. L., & Kohnke, L. (2024). The effects of generative AI on initial language teacher education: The perceptions of teacher educators. *System*, *122*, Article 103290. https://doi.org/10.1016/j.system.2024.103290

Nguyen, G. N. H., Bower, M., & Stevenson, M. The discourse of design: Patterns of TPACK Contribution during pre-service teacher learning design conversations. *Education and Information Technologies*, *27*, 8235–8264. https://doi.org/10.1007/s10639-022-10932-w

Pokrivcakova, S. (2019). Preparing teachers for the application of AI-powered technologies in foreign language education. *Journal of Language and Cultural Education*, *7*(3), 135–153. https://doi.org/10.2478/jolace-2019-0025

Schmid, M., Brianza, E., & Petko, D. (2021). Self-reported technological pedagogical content knowledge (TPACK) of pre-service teachers in relation to digital technology use in lesson plans. *Computers in Human Behavior*, *115*, Article 106586. https://doi.org/10.1016/j.chb.2020.106586

Shadiev, R., & Feng, Y. (2024). Using automated corrective feedback tools in language learning: a review study. *Interactive Learning Environments*, *32*(6), 2538–2566. https://doi.org/10.1080/10494820.2022.2153145

Shin, D., & Lee, J. H. (2024). Moving from off-the-shelf chatbots to a user-designed bespoke L2 chatbot. *Language Learning & Technology*, *28*(1), 1–14. https://hdl.handle.net/10125/73581

Shulman, L. S. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher*, *15*(2), 4–14. https://doi.org/10.3102/0013189X015002004

Sun, Y., Strobel, J., & Newby, T. J. (2017). The impact of student teaching experience on pre-service teachers' readiness for technology integration: A mixed methods study with growth curve modeling. *Educational Technology Research & Development*, *65*, 597–629. https://doi.org/10.1007/s11423-016-9486-x

Tseng, J.-J., Chai, C. S., Tan, L., & Park, M. (2022). A critical review of research on technological pedagogical and content knowledge (TPACK) in language teaching. *Computer Assisted Language Learning*, *35*(4), 948–971. https://doi.org/10.1080/09588221.2020.1868531

Tseng, J.-J., Cheng, Y.-S., & Yeh, H.-N. (2019). How pre-service English teachers enact TPACK in the context of web-conferencing teaching: A design thinking approach. *Computers & Education*, *128*, 171–182. https://doi.org/10.1016/j.compedu.2018.09.022

Wang, Y. F., & Petrina, S. (2013). Using learning analytics to understand the design of an intelligent language tutor–Chatbot Lucy. *International Journal of Advanced Computer Science and Applications*, *4*(11), 124–131. https://doi.org/10.14569/IJACSA.2013.041117

Yue, M., Jong, M. S.-Y., & Ng, D. T. K. (2024). Understanding K–12 teachers' technological pedagogical content knowledge readiness and attitudes toward artificial intelligence education. *Education and Information Technologies*, 29, 19505–19536. https://doi.org/10.1007/s10639-024-12621-2

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