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Systematic Review

A Systematic Review of Technology Integration in Developing L2 Pragmatic Competence

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Abstract: A growing body of research has explored how technology can enhance the development of pragmatic competence in a second language (L2). This systematic review synthesizes 37 empirical studies published between 2015 and 2024, focusing on various technological applications such as computer-mediated communication (CMC), interactive automated dialogues, virtual environments, and digital games. The analysis highlights that these tools promote pragmatic development by providing authentic or semi-authentic interaction, contextualized learning, and personalized practices. Meanwhile, the review also uncovers key challenges from both technological constraints and individual dimensions. Based on the findings, this review suggests several directions for future research. Further studies should adopt longitudinal, multimodal, and socially situated approaches, explore emerging generative AI technologies, and examine the interaction between individual learner differences and technological affordances to increase understanding of this evolving field.

Keywords: technology integration; pragmatic competence; second language (L2); effectiveness; affordances; challenges; research implications

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1. Introduction

1.1. Theoretical Background of Pragmatic Competence

Second language (L2) pragmatic competence, the ability to understand and use L2 appropriately in various sociocultural contexts, is a critical component of language competence (Laughlin et al., 2015; Taguchi & Roever, 2017). Due to the development and variation in the conceptualization of pragmatic competence, existing theoretical frameworks in L2 pragmatics research can be categorized as cognitive-psychological and social paradigms. The cognitive-psychological perspective is predominant in previous L2 pragmatics research. Its popularity is related to the traditional conceptualization of pragmatic competence as a component of communicative competence models (Bachman, 1990; Canale & Swain, 1980). In these early models, pragmatic competence involves two dimensions: functional knowledge (or pragmalinguistic knowledge, i.e., the relationship between forms and functions) and sociolinguistic knowledge (or sociopragmatic knowledge, i.e., the understanding of contextual variables that influence language use) (Taguchi, 2019). In line with these models, the cognitive-psychological approaches view pragmatic competence as a psycholinguistic ability that exists within individuals as a stable construct, independent of context (Taguchi & Roever, 2017). Similarly, factors (e.g., instruction,

individual differences, and technology) that influence pragmatic development were also treated as discrete independent variables.

Unlike the cognitive-psychological approaches, socially oriented approaches view L2 pragmatic development as a socially situated activity that is co-constructed by all participants during the interaction. With the rise of discursive pragmatics (Kasper, 2006) and interactional competence (Young, 2011), pragmatic competence has evolved into a more dynamic and dialogic component in interaction. The form–function–context associations are not static or pre-determined; instead, they emerge and evolve throughout the interaction, co-constructed by the interlocutors. These associations constantly shift in response to dynamic factors such as the speakers' attitudes, affect, and the direction of discourse (Taguchi, 2019). Socially oriented theoretical models include sociocultural theory, language socialization, and conversation analysis.

As synthesized by Taguchi (2019), pragmatic competence is a construct with multiple aspects of linguistic and sociolinguistic knowledge, interactional abilities, and agency. This systematic review includes studies that conceptualized pragmatic competence either as a cognitive-psychological construct or as a socially situated ability.

1.2. Technology and L2 Pragmatic Competence

Developing L2 learners' pragmatic competence is challenging. The form–function–context mappings of pragmatics, which do not systematically follow one-to-one correspondences, are intricate and variable (Taguchi, 2015). Pragmatic rules also vary across cultures, so culture-specific norms and conventions might bring difficulties to L2 learners, even those with advanced proficiency levels. Additionally, learners' pragmatic competence can be effectively enhanced when interacting with other language users, but traditional classroom environments often lack varied sociocultural situations and authentic contextualized interaction. Technology, especially with the rise of digital learning tools, has emerged as a promising solution to overcome these barriers by providing learners with authentic interaction opportunities and context-rich learning environments (Taguchi, 2019).

Over the last two decades, there has been a rapid growth of research on technology-mediated L2 pragmatics. Technologies such as computer-assisted language learning (CALL), computer-mediated communication (CMC), mobile-assisted language learning (MALL), and, more recently, artificial intelligence (AI) and robot-assisted language learning (RALL) have been employed in both instructional and communicative modalities in this research field. A series of review studies were undertaken accordingly, recognizing how technology has contributed to the development of L2 pragmatic competence (González-Lloret, 2021, 2022; Sykes, 2018; Sykes & González-Lloret, 2020; Tang, 2019a). These review studies have in turn motivated empirical studies using improved research designs and more innovative tasks. While these reviews yield valuable insights and encourage more empirical efforts to integrate technology into L2 pragmatic development, some research gaps remain. Notably, most existing reviews are narrative ones that analyzed previous findings but did not conduct a systematic literature search, partly because of the comparatively small number of empirical studies. Tang's review (Tang, 2019a) systematically synthesized 21 data-based empirical studies published up to 2015, lacking recent innovations in educational technology (e.g., virtual reality, MALL, RALL, AI tools).

In light of the increasing number of empirical studies during the past ten years, this review study aims to provide a comprehensive analysis of empirical studies from 2015 to 2024 on the use of technology for the development of L2 pragmatic competence. By synthesizing the latest research, this review will examine the types and roles of technologies in L2 pragmatic development, assess their effectiveness, and identify their affordances and challenges. This review will also synthesize the research gaps in existing research and

identify potential areas for future research. This review addresses the following research questions:

(1) What technologies are applied to develop L2 pragmatic competence, and what are the main findings concerning the effects of these technologies?

(2) What are the affordances and challenges of applying technologies for L2 pragmatic development?

2. Methods

The literature search was restricted to high-quality peer-reviewed journal articles identified as empirical studies on the development of L2 pragmatic competence and published in English from 2015 to 2024. Although the contributions of conference papers, book chapters, and dissertations should be acknowledged, the current review is restricted to peer-reviewed journal articles because of their high quality and significant impact (Lyu & Qi, 2020). The articles were mainly retrieved from the Web of Science (SSCI) and Linguistics and Language Behavior Abstracts (LLBA) databases, which include high-quality peer-reviewed articles related to our research topic. A literature search was conducted in these databases, using the search strings of (technology* OR computer) AND (second language OR foreign language OR L2) AND (pragmatic* OR pragmatic competence OR speech act*) with Timespan = 2015–2024. Table 1 summarizes and presents the inclusion and exclusion criteria.

Table 1. Inclusion and exclusion criteria.

Inclusion	Exclusion
Peer-reviewed journal articles (SSCI and CALICO)	Review articles, conference papers, and book chapters
Published between 2015 and 2024	Published before 2015
Empirical research articles	Non-empirical research articles
Focus on technology application for the development of L2 pragmatic competence	Not focus on technology application for the development of L2 pragmatic competence
Written in English	Written in other languages

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 Statement (Page et al., 2021), which defines an evidence-based, minimal set of items for reporting in systematic reviews, was adopted to identify, screen, and select articles through four phases (see Figure 1). In the first phase, 148 articles were generated through database searching, and 12 articles were identified through two additional sources. To include other possible articles where the keyword search might not have been retrieved, a close look at some key researchers' publication lists generated eight SSCI articles and four CALICO Journal articles for review. In the second phase, 10 duplicate articles were first removed, and 138 from databases remained. Two researchers then evaluated the title, abstract, and keywords of each article to exclude 108 unrelated records that did not focus on technology-enhanced L2 pragmatic development. After this phase, a total of 42 articles were generated, including 30 from databases and 12 from other resources. Subsequently, the full text of each article was reviewed by the same two researchers to determine if it met the above inclusion criteria. As shown in Figure 1, a total of 37 empirical studies were included in this review and then coded and analyzed by the authors.

The data analysis involved a thorough review of 37 selected studies to extract detailed data relevant to the aforementioned research questions. The coding scheme included publication details (year, author, title, publication source), theoretical framework, participants, technological application, research method, research targets, data collection

methods, main findings (e.g., effects of technologies, learning outcomes), affordances, and challenges of technologies. Two researchers independently coded each study and discussed the coding materials until a consensus was reached.

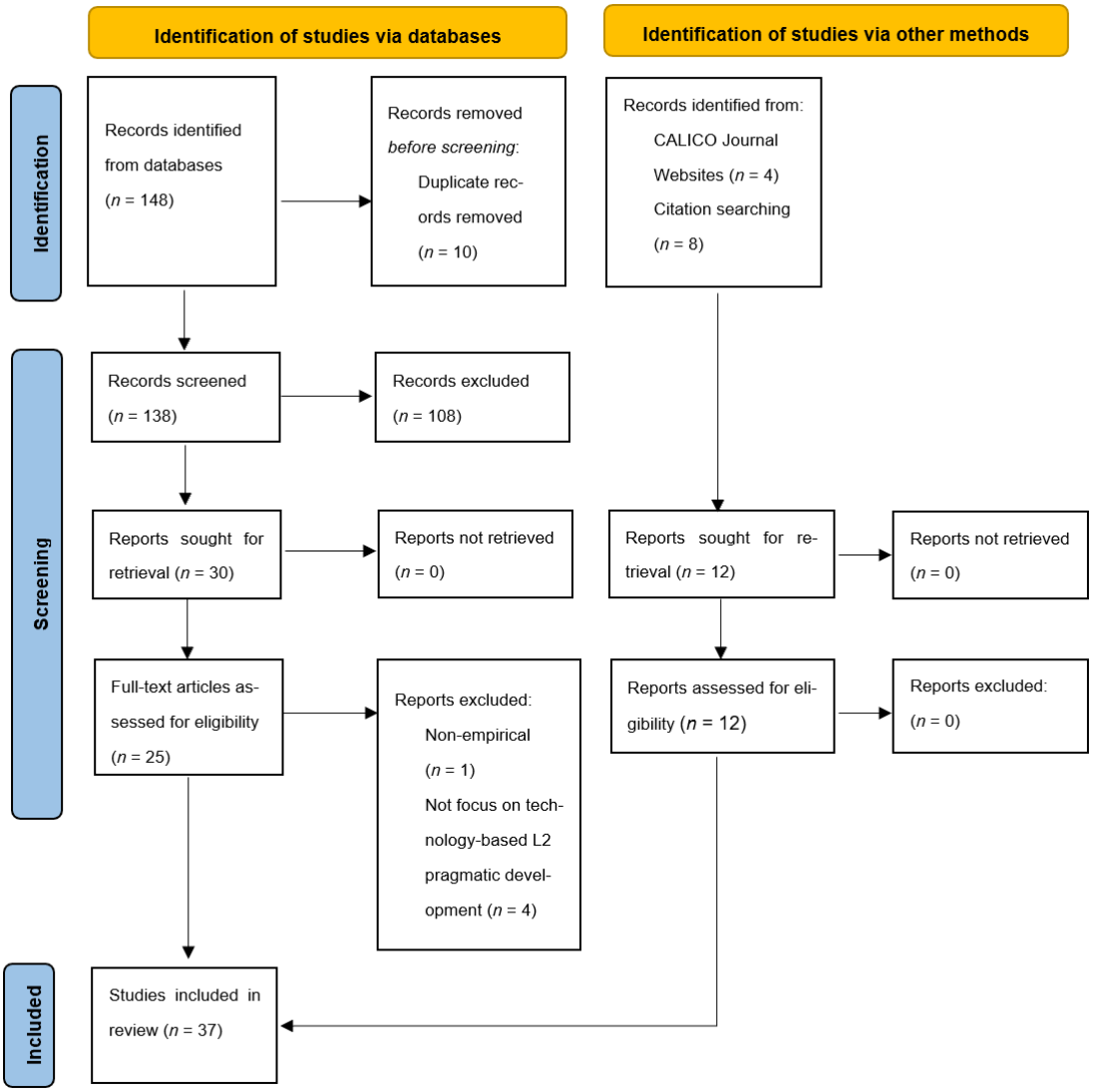

Figure 1. PRISMA flowchart for literature search.

3. Findings

3.1. Technologies and Their Effects

After synthesizing all the articles, we found a great diversity in the types of technologies in developing L2 learners' pragmatic competence. As shown in Table 2, these technologies are classified into different categories depending on their functions and characteristics. The most commonly used technology was computer-mediated communication (CMC), followed by interactive automated dialogues and virtual reality platforms. Although a few studies adopted two technological tools, they are classified into the technological type they mainly focused on or used as an innovative application. For example, in Tang and Taguchi's (2021) study that compared the instructional effects of digital games and traditional picture-based online lessons, technology was categorized into the former type.

Table 2. Technological integration.

Technological Integration		Statistics			
		Number		Percentage	
Computer-mediated communication (CMC)	Video conferencing	5	15	13.5%	40.5%
	Instant messaging (IM)	5		13.5%	
	Email	4		10.8%	
	Social networking	1		2.7%	
Interactive automated dialogues	Computer-simulated conversations	4	8	10.8%	21.6%
	Spoken dialogue systems (SDS)	3		8.1	
	Robot-assisted language learning (RALL)	1		2.7%	
Virtual environments	Digital games	5	7	13.5%	18.9%
	Immersive virtual reality	2		5.4%	
Website		4		10.8%	
Mobile seamless		1		2.7%	
Corpus		1		2.7%	
Audiovisual material		1		2.7%	
Total		37		100%	

3.1.1. CMC

The review found that computer-mediated communication (CMC) has been the research trend in the last 10 years. Herring (1996) defined CMC as "communication that takes place between human beings via the instrumentality of computers" (p. 1). CMC tools provide authentic, interactive contexts by connecting L2 learners with other speakers. Fifteen studies explore the use of CMC in different settings such as video conferencing (e.g., Zoom), instant messaging (e.g., WhatsApp), email, and social networking (e.g., Facebook). Within these, studies utilizing video conferencing and instant messaging (IM) are the most frequent. Both synchronous CMC (11 studies) and asynchronous CMC (five studies) were examined. The former involves real-time, instant communication between participants, while the latter allows for delayed communication.

As for the role of CMC in L2 pragmatic development, the review found that eight studies used CMC as a medium for communication, while the other seven studies employed it as telecollaboration that enables collaborative learning activities and guided interaction between L2 learners with native speakers or language partners in geographically distant locations.

The eight former studies that incorporated CMC as a communicative tool explored L2 learners' pragmatic perception or production by collecting naturalistic data from participants and then conducting discourse analysis. These studies include four using synchronous text-based IM, three using email, and one using social networking. Several findings are synthesized from these studies. First, CMC stimulates authentic interaction and engagement between L2 learners and native speakers or peers, which is essential for pragmatic development. It provides learners with more diversified interactional practices to develop their interactional pragmatic competence, such as the use of orthography and emoticons (Maa & Taguchi, 2022), sequence organization in conversation closing (Abe & Roever, 2020), and language play and socialization (Lantz-Andersson, 2017). Second, text-based interaction does not invariably play a more facilitative role in enhancing L2 pragmatic development due to the lack of verbal, social, and contextual feedback (García-Gómez, 2022; Tang, 2019b). Third, combining CMC tools with pragmatic instruction or specific training can enhance learners' effective communication and pragmatic competence. While CMC was not used as an instructional tool in these eight studies, three of them provided pragmatic instruction beyond CMC contexts, such as classroom-based teaching (Nguyen, 2018; Tang, 2019b; Usó-Juan, 2022). These studies highlight the

importance of combining explicit instruction with CMC tools to maximize pragmatic development.

In contrast, the seven studies utilizing CMC as telecollaboration incorporated it not only to teach L2 pragmatics but also as a platform for learners to practice target pragmatic features through authentic interaction. Video conferencing is the most frequently used tool in telecollaboration. In fact, all five studies utilizing video conferencing were based on telecollaboration. The remaining two studies adopted email and instant messaging. For example, Jung and Fu (2023) investigated how integrating Zoom video conferencing and explicit pragmalinguistic support influenced 12 pairs of L2 English learners' oral and written performance in a telecollaborative suggestion-giving task. In Eslami et al. (2015), email was used to provide explicit or implicit request-making instruction through asynchronous interaction between Iranian L2 English learners and their US-based language partners. Findings in these studies indicate that, when combined with explicit instruction or form-focused practices, CMC can better develop L2 learners' pragmatic competence.

3.1.2. Interactive Automated Dialogues

Eight studies explored the potential of interactive automated dialogues for L2 pragmatic development, including the Spoken Dialogue System (SDS), computer-simulated conversations, and humanoid robot interactions. SDS is a fully automated agent capable of conversing with a user. Three studies used SDS to allow learners to practice pragmatic features (e.g., requests, conversation opening and closing) through real-time spoken conversations in simulated contexts and regarded it as a valuable application for the development of form–function–context mappings in pragmatics. Two of them compared learners' interactions with SDS versus face-to-face interactions and found that the former were more direct and transactional, while the latter included more functional and relational discourse (e.g., more frequent supportive moves and modifications) (Dombi et al., 2024; Timpe-Laughlin et al., 2023). Compared to face-to-face modality, SDS provides a structured, replicable, low-stakes environment that is ideal for the focused practice of specific pragmatic features.

Similarly, four studies explored computer-simulated conversations that enable L2 English learners to practice speech acts (e.g., requests and refusals) in multi-turn, scenario-based interactions. In Sydorenko and her colleagues' studies, for example, learners first observed native English speakers' models through video simulations that resembled real-life situations and then provided responses or made requests at different points where the video paused (Sydorenko, 2015; Sydorenko et al., 2020). The findings highlighted the effectiveness of simulations for pragmatic instruction. The simulations significantly enhanced learners' pragmatic competence (e.g., speech act strategies and pragmatic awareness).

In addition, Alemi and Haeri (2020) conducted a RALL study that adopted a humanoid robot to teach Persian preschool English learners simple requests and gratitude expressions through interactive automated dialogues. It was found that the RALL group significantly outperformed the non-RALL group in pragmatic performance. The humanoid robot also facilitated learners' motivation and engagement due to its interactive and supportive behaviors.

3.1.3. Digital Games or Virtual Environments

In terms of other technologies, seven studies used digital games or virtual environments for L2 pragmatic development. While CMC supports authentic interactions with real interlocutors, virtual environments offer more controlled, immersive, and contextualized settings with realistic social cues for practicing L2 pragmatics.

Five studies explored the effects of virtual games on L2 pragmatic competence, including one with a massively multiplayer online role-playing game (MMORPG) and four with research-designed role-play gaming platforms. Taguchi and her colleagues developed a series of scenario-based gaming platforms (e.g., Questaurant) and investigated their effectiveness in teaching L2 pragmatics, such as Chinese formulaic expressions (Taguchi et al., 2017; Tang & Taguchi, 2020, 2021). These platforms incorporate gamification elements to encourage language practice, such as a plot and setting, interaction with animated characters, instant feedback, clues for task completion, and rewards. For example, in the digital game Questaurant, learners played the role of a robot employee in a restaurant and interacted with animated characters in different scenarios. These studies highlighted the potential of digital games in L2 learners' pragmatic development and motivation enhancement. While the comparative effects between digital games and computer-assisted online lessons showed no significant difference, the game group was significantly more motivated (Tang & Taguchi, 2021). Unlike Taguchi and her colleagues' studies that examined game-based learning within a self-access structured semi-immersive environment, Zhang (2023) explored game-enhanced learning within a commercial MMORPG, World of Warcraft (WoW). As an intervention, WoW played the role of CMC and exposed 105 L2 English learners to four weeks of authentic and spontaneous interactions with L1 English speakers. Results showed the facilitative and lasting impact of game-enhanced communication via WoW on learners' production of compliment responses.

Another two studies explored the use of immersive virtual reality, defined as a computer-generated 360-degree virtual space experienced through a head-mounted device (Taguchi, 2021, 2022). Both studies compared participants' (native and non-native speakers) role-play speech act performance in two technological environments: immersive VR versus computer-based written scenarios with no visual input. Taguchi found that participants in the VR group spoke more slowly and used more modifications. According to the interview data, she found that participants in the VR condition used audiovisual cues to regulate their actions and generated greater emotional responses (Taguchi, 2021). The findings demonstrated that immersive VR provides a more engaging and contextually rich environment that can encourage their appropriate language use. However, it also imposed a higher cognitive load, probably leading to a reduction in speech fluency.

3.1.4. Self-Access Websites

Four studies implemented self-access websites to teach L2 pragmatics by providing learners with explicit instruction and consciousness-raising exercises. For example, two studies developed research-designed websites to teach expressions of gratitude (Yang, 2024) or requests (Qi & Lai, 2017) in Chinese. Timpe-Laughlin et al. (2021) implemented an interactive learning platform, Words at Work, to enhance L2 English learners' pragmatic awareness in workplace communication. Kerber et al. (2023) used a well-developed pragmatic learning platform, Dancing with World, designed by previous researchers to teach L2 Spanish apology. Findings show that self-access websites effectively develop L2 pragmatic competence through explicit, contextualized instruction and interactive tasks.

3.1.5. Other Technologies

In this review, other technological applications, such as mobile seamless (Lan & Lin, 2016), corpus (Bardovi-Harlig et al., 2017), and audiovisual materials with captioning (Baron & Celaya, 2022), were also reported to be effective for L2 pragmatic development. For example, Lan and Lin (2016) adopted a mobile seamless learning platform to bridge classroom and real-world learning and found that L2 learners made significantly fewer errors when engaging in language tasks in the real world than those in the classroom.

3.2. Affordances and Challenges of Technology

3.2.1. Affordances

Authentic and Immersive Communication

Technology offers an authentic or immersive learning environment where L2 learners can practice pragmatics during real-time communication. Authentic contexts and social interaction have been acknowledged as two essential elements in second language acquisition by both researchers and practitioners (Ellis, 2005). Technological applications, exemplified by SCMC tools, virtual environments, and SDS, allow for real-time communication and instantaneous feedback among interlocutors, thereby overcoming certain extant obstacles in L2 pragmatic development (e.g., the paucity of authentic contexts for practice, difficulty in providing timely feedback). This type of exchange was found to be beneficial for practicing most pragmatic features (e.g., speech acts) that require learners to adjust their language use based on the immediate context and instant feedback. For instance, Cunningham (2016) observed that synchronous video conferencing allows learners to experiment with different levels of request directness and various modifications in a natural, professional setting. The immediacy of feedback further supported learners in meaning negotiation and pragmatics adjustments, promoting more effective and pragmatically appropriate language use.

Technology can also facilitate L2 pragmatic development by providing direct sociocultural interaction and collaborative learning with target language speakers across distances. By integrating technologies, L2 learners, especially those in the foreign language context, have easier access to native speakers. In this review corpus, nine studies required learners to engage in interaction with target language speakers through CMC (seven studies), the digital game WoW (one study), and a mobile seamless platform (one study). For example, some of them reported that telecollaborations, whether through SCMC or ACMC, provide learners with explicit instruction and opportunities to foster both pragmalinguistic and sociopragmatic competence of the target L2 (Cunningham, 2016, 2017; Eslami et al., 2015; Iraheta, 2024). These telecollaborations possess a pronounced intercultural dimension and, therefore, contribute to the development of learners' awareness of sociopragmatics and intercultural competence. García-Gómez (2022) found that WhatsApp chat offers a culturally relevant space for Spanish and British students to negotiate pragmatic meanings in L2 English, although challenges arise without explicit guidance.

Contextualization of Pedagogical Materials and Tasks

It was found that the contextualization of learning was another noteworthy affordance of technology for developing L2 pragmatic competence. The contextualization effect of technology is particularly beneficial for pragmatic learning, as pragmatics is inherently dependent on the context of language use (Taguchi, 2019). Pragmatic competence involves understanding and appropriately using language across diverse social and cultural contexts. In previous L2 pragmatics teaching and research without technology, context is typically presented through brief situational descriptions or dialogues. Learners are required to read and imagine the relevant scenarios, and sometimes they need to play an imaginary role to give responses or engage in interaction. In this review corpus, technologies, such as digital games, virtual reality, interactive automatic dialogue systems, and research-designed websites, provided a more meaningful and contextualized space by incorporating audiovisual or virtual scenarios, multimodal input, and built-in real or animated characters.

Some studies used well-designed computer-based learning platforms to offer different social contexts through audiovisual or video resources for L2 pragmatic learning or

assessment (Kerber et al., 2023; Taguchi et al., 2017; Timpe-Laughlin et al., 2021). For example, Timpe-Laughlin et al. (2021) reported the effectiveness of a research-developed learning platform, Words at Work, for developing learners' awareness of workplace pragmatics in L2 English. The instruction of pragmatic features (e.g., speech acts and implicatures) in this platform was organized by a real-life job path that includes nine professional scenarios. In each scenario, learners engaged in comprehensive and productive pragmatics tasks, incorporating extensive audiovisual and video-based content to enhance contextualization. While learners were exposed to contextualized materials throughout these platforms, they usually observed contextualized language use from a third-person view rather than directly engaging in the interaction. In contrast, some other studies used more immersive and interactive technological applications, such as computer-simulated immersive tasks (e.g., Sydorenko et al., 2020), digital games (e.g., Tang & Taguchi, 2020), and immersive virtual reality (e.g., Taguchi, 2021), to afford learners with an opportunity to interact with a variety of characters in diverse social settings. Through dynamic contextualized interactions, learners could adjust pragmalinguistic forms and strategies in conjunction with certain sociopragmatic contextual factors, receive timely and individualized feedback, and even retry the interaction for a different outcome.

Active Engagement and Personalized Learning

Technology also afforded active and personalized learning and engagement for L2 pragmatics learners. This review found that technology enhanced learners' active engagement by immersing them in interactive, contextualized tasks and motivating them through gamified elements. For example, targeting L2 Chinese formulaic expressions, Tang and Taguchi (2020, 2021) examined the effects of the self-access scenario-based digital game Questaurant on learning outcomes and learner motivation. Motivation was primarily investigated through questionnaire surveys and semi-structured interviews, focusing on how game features (e.g., context, goals, feedback, and interactivity) influenced learner engagement. Empirical evidence indicated the positive role of digital games in active engagement and motivational appeal for pragmatic learning. Specifically, game-based treatment resulted in stronger learner motivation than online teaching treatment without game features. The interview data revealed that integrating context and interactivity in the game provided an engaging learning experience, and explicit feedback via text directly facilitated pragmatic learning. Features such as role-playing and goals (e.g., rewards) made learning enjoyable and intrinsically motivating. However, learners also mentioned concerns about the motivational appeal of rewards and implicit feedback (e.g., facial expressions and sounds from built-in characters).

Some other studies also reported learners' active engagement through various technologies, although they primarily elicited exploratory discussions and did not recognize learner engagement or its related factors (e.g., motivation, enjoyment, time-on-task) as a research focus (Lan & Lin, 2016; Zhang, 2022). For example, Alemi and Haeri (2020) found that the application of a humanoid robot created an engaging learning environment that afforded preschool L2 English learners' attention, enjoyment, and motivation.

Simultaneously, technology supported personalized learning by offering individualized interactions, flexible practice experiences, and opportunities for autonomous learning. Some technologies (e.g., CMC) provide learners with flexible space and more preparation time to conduct meaningful communication and receive personalized feedback without interruptions that may happen in a physical classroom (García-Gómez, 2022; Maa & Taguchi, 2022; Zhang, 2023). Additionally, technology can foster learner autonomy and agency. Learners could independently decide to post and comment on social networking sites, exchanging their thoughts with online peers (Lantz-Andersson, 2017). They could also select relevant digital games or educational websites for self-directed learning and

engage in pragmatic practice at their own pace. Learners experienced the consequences of their pragmatic choices through timely, individualized feedback (Tang &Taguchi, 2021).

3.2.2. Challenges

While technology generally served facilitative affordances in L2 pragmatic development, there were nonetheless challenges in adopting technology in L2 pragmatics research. This review identified some challenges from both technological and individual dimensions.

Technological-Level Concerns

At the technological level, the limitations of specific technology were found to bring particular challenges for L2 pragmatic development. While some CMC tools and SDS offer opportunities for authentic or semi-authentic interaction, they often fail to replicate the full contextual richness of face-to-face communication (García-Gómez, 2022; Tang, 2019b; Timpe-Laughlin et al., 2023). For example, the lack of tones of voice and non-verbal cues (such as body language and facial expressions) in text-based technological applications reduces the contextual richness of interaction, which may hinder learners' ability to understand the sociopragmatic meaning behind messages and result in inappropriate language use. García-Gómez (2022) argued that WhatsApp did not create a natural enough context for L2 English learners to produce contextually relevant utterances when interacting with native speakers during small focus group discussions. The WhatsApp interaction revealed pragmatic failures and misunderstandings and thus caused interpersonal tension within groups, leading learners to have negative attitudes about using WhatsApp as a learning tool. In Tang's (2019b) study, text-based CMC was not less effective than face-to-face interaction in promoting the learning of Chinese modal verbs, a type of pragmatic modifier. Tang found that the text-based CMC group in this study used symbols and fragments more frequently, which reduced opportunities for practicing pragmatics forms. However, it should be acknowledged that the multimodal digital resources available in technological tools, such as emoji, symbols, and unique punctuation systems, could also provide contextualization cues and contribute to interactional pragmatic development, especially in meaning negotiation, emotion expression, and the realization of socializing purposes (Lantz-Andersson, 2017; Maa & Taguchi, 2022; Tang, 2019b). The challenge is to foster L2 learners' digital literacy related to the CMC-specific features and raise their awareness of the sociopragmatic norms governing these features. It is also challenging to develop learners' understanding of how digital resources interact with traditional pragmatic frameworks in digital communication contexts.

Teachers' Challenges

With regard to individual-level concerns, both teachers and learners face challenges in the application of technology for pragmatic instruction. From teachers' perspectives, some studies reported that the technology-based pedagogical designs and implementation for L2 pragmatics required considerable time, effort, and sometimes sufficient financial support. Iraheta (2024) pointed out that untenured instructors need significant time commitment to design online virtual platforms and telecollaboration, which divert time and attention from other research endeavors. Cunningham (2016) found it complex and costly to integrate telecollaboration into the curricular framework of regular language programs and track learners' longitudinal pragmatic performance. Alemi and Haeri (2020) also highlighted the financial burden of using humanoid robots. In addition, digital game design is also quite challenging and time-consuming. Tang and Taguchi (2020, 2021) illustrated the complexity of developing a genuinely engaging and goal-oriented educational game for effective pragmatic instruction, as good design work should consider a

variety of aspects such as adequate and diverse scaffoldings, an appeal rewards system, and alignment with curriculum goals. To meet teaching and research purposes, some compromises were made in their game design, which lessened the appeal and authenticity of the game and reduced learners' motivation. In fact, educational games are frequently perceived by students as uninteresting and irrelevant to their experiences (Sykes, 2013). The time constraints and insufficient support may cause teachers to have negative attitudes towards new technology applications.

Learners' Challenges

From learners' perspectives, one concern identified from the reviewed corpus is learners' unfamiliarity with technology or lack of relevant digital literacy, which may affect the effective application of technology. Tang (2019b) suggested that participants' limited experience with written CMC in L2 Chinese and insufficient typing/writing skills might be the potential reason for the CMC group's lower performance with Moodle chatting compared to the face-to-face group. Taguchi (2021, 2022) found that learners in immersive VR environments had increased cognitive loads. In such environments, they need to process both linguistic input and dynamic visual stimuli, which can reduce their speech fluency and affect pragmatic task performance. Moreover, some other challenges related to their proficiency level or individual difference factors in using technology were retrieved from the review studies. Due to insufficient target language proficiency, some telecollaborative projects were found to cause L2 learners' anxiety and frustration as a result of being evaluated and misunderstood by native speakers (e.g., García-Gómez, 2022).

4. Discussion

The findings of this systematic review offer critical insights into the role of technology in developing L2 pragmatic competence in the past 10 years. Despite insightful efforts, several gaps still need to be addressed in existing technology-based L2 pragmatics research.

First, there is a limited exploration of how learners' individual differences mediate the effects of technologies on L2 pragmatic development. Technology itself does not automatically and inherently bring effective communication and lead to the development of pragmatic competence (Vandergriff, 2013). In addition to effective pedagogical designs and implementations, individual differences such as language proficiency, digital literacy, motivation, and agency may also significantly affect learners' engagement with technology-mediated pragmatics tasks. As demonstrated in García-Gómez's (2022) study, simply interacting via CMC does not guarantee effective pragmatic learning. The quality and depth of interaction are critical for pragmatic development. Motivation and learner agency are also important. Studies suggest that intrinsically motivated learners are more likely to engage in telecollaboration and digital games, sustaining meaningful interaction despite technological challenges (Tang & Taguchi, 2021). Moreover, digital literacy, including familiarity with technological tools and multimodal communication, mediates how learners adapt to technology-based pragmatics tasks. Learners proficient in using digital platforms may benefit more from interactive environments such as VR and SDS, while learners with less digital literacy might experience cognitive overload.

Since individual differences influence how learners interact with technologies and tasks, it is necessary to investigate how the interplay of these factors collectively impacts L2 pragmatic development (González-Lloret, 2022). Future studies should explore these individual differences through in-depth, longitudinal studies to better understand how different learner characteristics interact with various technologies. Understanding these dynamics can inform personalized learning designs and optimize technology-mediated pragmatic instruction.

Second, the socialization perspective on L2 pragmatics development is underexplored in the reviewed studies. Language socialization is the process through which novices learn to become competent members by interacting with expert members of a specific cultural community (Ochs & Schieffelin, 1984). As for L2 pragmatic development, language socialization views pragmatic competence as a dynamic and dialogic component in interaction and examines learners' inter-individual developmental processes, whereas the cognitive-psychological approaches mainly focus on intra-individual cognitive processes (Taguchi & Roever, 2017). L2 individuals can acquire and internalize pragmalinguistic forms and sociopragmatic knowledge through a dynamic interactive process. While some studies incorporated telecollaboration and online intercultural exchanges with native speakers, they primarily focused on pragmatic features (e.g., requests) without fully examining how learners internalize pragmatics norms through continuous interaction. Research on virtual spaces also rarely investigated how learners develop sociopragmatic awareness through role-playing and immersive simulations. Additionally, the potential of authentic digital communities, such as social networking sites and online chatting, to serve as spaces for socialization remains under-researched. These platforms offer rich opportunities for learners to engage in authentic, culturally embedded communication. However, the reviewed studies often recognized such environments as experimental contexts rather than spaces for sustained sociocultural development. Future research should investigate how learners' participation in digital communities fosters sociopragmatic awareness and sociocultural competence over time. Longitudinal studies exploring learners' evolving interaction patterns in various online contexts could provide deeper insights into how technology-mediated environments support socialization processes.

Based on socialization theory or complex dynamic systems theory, researchers argue that individual difference factors interact with each other and change dynamically in context (Dörnyei, 2009; Taguchi, 2019). It is not context or individual difference per se, but the constellation of individual differences mediated by context and time that leads to pragmatic development (Taguchi & Roever, 2017). Thus, further research within this framework is encouraged to explore the complex interaction among technology-based context, individual differences, and pragmatic development.

Third, while existing studies have examined the use of a great variety of technologies in diverse instructional and interactional contexts, more technological innovations are required. A few studies adopted artificial intelligence (AI) tools such as SDS, but they mainly examined learners' current or single-moment developmental patterns of target pragmatic features or compared these patterns with those in face-to-face interactions. Few empirical investigations have explored how AI-driven tools can facilitate pragmatic learning through adaptive, interactive scenarios or focused instruction. Moreover, no research was found to specifically examine the potential role of generative AI, such as ChatGPT, in fostering L2 pragmatic competence. Generative AI models can create different intercultural scenarios, generate contextualized dialogues (e.g., making L2 requests in formal and informal settings), and provide explanations of pragmatic rules and strategies across cultures (e.g., politeness and directness in L2 Chinese). They can also be used to play different roles from varied cultural backgrounds and engage learners in dynamic immersive interaction or focused pragmatics practices. As such, investigating how generative AI can facilitate personalized learning, provide real-time interaction, and support pragmatic development through simulated conversations represents a promising but underexplored research avenue. Key concerns include the quality of generated responses, the extent of contextual appropriateness, and the models' ability to adapt to individual learner needs.

Fourth, current technological applications in L2 pragmatics often overlook multimodal communication despite its growing relevance in digital contexts. Non-verbal elements such as visual cues, emojis, and multimedia content play a crucial role in meaning-

making, yet these aspects remain insufficiently studied. In this review corpus, only Maa and Taguchi (2022) focused on unique interactional resources such as orthography (e.g., non-standard spellings) and emoticons in online messaging platforms. Existing platforms like Instagram, Snapchat, TikTok, and Twitch offer rich, multimodal interaction environments but are rarely leveraged for L2 pragmatic research (González-Lloret, 2021). Investigating how learners interpret implicatures conveyed through emojis, text–image combinations, and video-based interactions could provide deeper insights into pragmatic development. Future research should explore how combining different communication modes affects learners' ability to comprehend and produce pragmatically appropriate communication in L2 contexts.

5. Conclusions

This review synthesized empirical studies from 2015 to 2024 on the use of technology for developing L2 pragmatic competence. The findings reveal a diverse range of technological tools, including CMC, interactive automated dialogues, virtual environments, and digital games. These technologies have significantly contributed to L2 pragmatic development by providing authentic interaction, contextualized learning, and personalized feedback. For example, video conferencing, SDS, and immersive VR provide learners with real-time, interaction-rich contexts. The inclusion of gamified elements further increases learner motivation and engagement. Despite these benefits, challenges exist. Technological limitations, such as reduced contextual richness in text-based CMC and high cognitive loads in immersive VR, can hinder pragmatic development. Additionally, teachers encounter substantial time and effort requirements when integrating technology into pragmatics instruction, while learners' individual differences (e.g., digital literacy and motivation) further mediate the effectiveness of technology-based instruction.

The findings of this review have some implications for both teaching practices and future research. For teachers and educational specialists, insights into diverse technologies can guide the selection of appropriate tools for developing L2 pragmatic competence. Technological advances overcome many previous barriers to pragmatic development and offer innovative methods for language delivery, classroom intervention, and self-directed learning. However, the effective integration of technology requires adequate teacher training, particularly in digital literacy and pedagogical strategies for incorporating technology into pragmatics instruction. To optimize the use of technology, teachers should receive ongoing professional development on how to design and implement technology-mediated tasks that encourage both in-class and out-of-class pragmatics learning. Offering explicit scaffolding and feedback during technology-based pragmatics instruction can more effectively enhance learner engagement and pragmatics outcomes. Moreover, teachers should provide learners with suggestions and training on the functions of technology and digital literacy skills as well as self-directed learning strategies.

Future studies should broaden the research scope by incorporating more technological innovations (e.g., generative AI), focusing on more varied interactional resources and multiliteracies, and examining diverse factors that affect technology-mediated L2 pragmatic development (e.g., teacher and learner training, individual differences). Research should also explore digital socialization processes to understand how learners internalize pragmatic features and rules through technology-based interaction. As such, more longitudinal and socially situated studies are necessary to investigate the complex interplay between technology integration, individual differences, and pragmatic development.

This review has several limitations. First, its focus on peer-reviewed journal articles may have excluded valuable insights from conference papers, book chapters, and dissertations. Second, the exclusion of non-English publications might have limited its comprehensiveness. Third, the review did not systematically categorize research methods and

data collection instruments, which could have provided a clearer methodological overview of the field. As such, further in-depth analysis is needed.

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References

Abe, M., & Roever, C. (2020). Task closings in L2 text-chat interactions. *CALICO Journal*, *37*(1), 23–45. https://doi.org/10.1558/cj.38562.

Alemi, M., & Haeri, N. S. (2020). Robot-assisted instruction of L2 pragmatics: Effects on young EFL learners' speech act performance. *Language Learning & Technology*, *24*(2), 86–103. http://hdl.handle.net/10125/44727.

Bachman, L. F. (1990). *Fundamental considerations in language testing*. Oxford University Press.

Bardovi-Harlig, K., Mossman, S., & Su, Y. (2017). The effect of corpus-based instruction on pragmatic routines. *Language Learning & Technology*, *21*(3), 76–103. http://llt.msu.edu/issues/october2017/bardovi-harligmossmansu.pdf.

Baron, J., & Celaya, M. L. (2022). 'May I do something for you?': The effects of audio-visual material (captioned and non-captioned) on EFL pragmatic learning. *Language Teaching Research*, *26*(2), 238–255. https://doi.org/10.1177/1362168821106700.

Canale, M., & Swain, M. (1980). Theoretical bases of communicative approaches to second language teaching and testing. *Applied Linguistics*, *1*(1), 1–47. https://doi.org/10.1093/applin/I.1.1.

Cunningham, D. J. (2016). Request modification in synchronous computer-mediated communication: The role of focused instruction. *The Modern Language Journal*, *100*(2), 484–507. https://doi.org/10.1111/modl.12332.

Cunningham, D. J. (2017). Methodological innovation for the study of request production in telecollaboration. *Language Learning & Technology*, *21*(1), 75–98. http://llt.msu.edu/issues/february2017/cunningham.pdf.

Dombi, J., Sydorenko, T., & Timpe-Laughlin, V. (2024). Openings and closings in human-human versus human-spoken dialogue system conversations. *Language Learning & Technology*, *28*(2), 30–58. https://hdl.handle.net/10125/73571.

Dörnyei, Z. (2009). *The psychology of second language acquisition*. Oxford University Press.

Ellis, R. (2005). Principles of instructed language learning. *System*, *33*, 209–224. https://doi.org/10.1016/j.system.2004.12.006.

Eslami, Z. R., Mirzaei, A., & Dini, S. (2015). The role of asynchronous computer mediated communication in the instruction and development of EFL learners' pragmatic competence. *System*, *48*, 99–111. https://doi.org/10.1016/j.system.2014.09.008.

García-Gómez, A. (2022). Learning through WhatsApp: Students' beliefs, L2 pragmatic development and interpersonal relationships. *Computer Assisted Language Learning*, *35*(5–6), 1310–1328. https://doi.org/10.1080/09588221.2020.1799822.

González-Lloret, M. (2021). L2 pragmatics and CALL. *Language Learning & Technology*, *25*(3), 90–105. http://hdl.handle.net/10125/73451.

González-Lloret, M. (2022). Technology-mediated tasks for the development of L2 pragmatics. *Language Teaching Research*, *26*(2), 173–189. https://doi.org/10.1177/13621688211064930.

Herring, S. C. (1996). *Computer-mediated communication: Linguistic, social and cross-cultural perspectives*. John Benjamins Publishing.

Iraheta, A. C. (2024). Learning with a purpose: Acquisition of compliments and compliment responses by beginning learners of Spanish in synchronous online exchanges. *System*, *123*, 103291. https://doi.org/10.1016/j.system.2024.103291.

Jung, J., & Fu, X. (2023). The impact of pragmalinguistic support on video-conferenced collaborative suggestion-giving task. *International Review of Applied Linguistics in Language Teaching*, *61*(3), 1083–1107. https://doi.org/10.1515/iral-2021-0138.

Kasper, G. (2006). Speech acts in interaction: Towards discursive pragmatics. In K. Bardovi-Harlig, J. C. Felix-Brasdefer, & A. S. Omar (Eds.), *Pragmatics and language learning* (vol. 11, pp. 281–314). University of Hawai'i at Manoa National Foreign Language Resource Center.

Kerber, N., Shea, J., & Tecedor, M. (2023). "Sorry, that's all I know!": A study on web-based pragmatic instruction for novice learners. *Foreign Language Annals*, *56*(3), 645–666. https://doi.org/10.1111/flan.12706.

Lan, Y. J., & Lin, Y. T. (2016). Mobile seamless technology enhanced CSL oral communication. *Educational Technology & Society*, *19*(3), 335–350. https://www.jstor.org/stable/jeductechsoci.19.3.335.

Lantz-Andersson, A. (2017). Language play in a second language: Social media as contexts for emerging sociopragmatic competence. *Education and Information Technologies*, *23*(2), 705–724. https://doi.org/10.1007/s10639-017-9631-0.

Laughlin, V. T., Wain, J., & Schmidgall, J. (2015). Defining and operationalizing the construct of pragmatic competence: Review and recommendations. *ETS Research Report Series*, *1*, 1–43. https://doi.org/10.1002/ets2.12053.

Lyu, B., & Qi, X. (2020). A review of research on technology-assisted teaching and learning of Chinese as a second or foreign language from 2008 to 2018. *Frontiers of Education in China*, *15*, 142–163. https://doi.org/10.1007/s11516-020-0006-8.

Maa, J., & Taguchi, N. (2022). Using L2 interactional-pragmatic resources in CMC: A case of Japanese orthography and emoji. *Language Teaching Research*, *26*(2), 190–212. https://doi.org/10.1177/13621688211064934.

Nguyen, T. T. M. (2018). Pragmatic development in the instructed context: A longitudinal investigation of L2 email requests. *Pragmatics*, *28*(2), 217–252. https://doi.org/10.1075/prag.00007.ngu.

Ochs, E., & Schieffelin, B. (1984). Language acquisition and socialization on grammatical development. In P. Fletcher & B. MacWhinney (Eds.), *The Handbook of child language* (pp. 73–94). Blackwell.

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., & Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ*, *372*, n71. https://doi.org/10.1136/bmj.n71.

Qi, X., & Lai, C. (2017). The effects of deductive instruction and inductive instruction on learners' development of pragmatic competence in the teaching of Chinese as a second language. *System*, *70*, 26–37. https://doi.org/10.1016/j.system.2017.08.011.

Sydorenko, T. (2015). The use of computer-delivered structured tasks in pragmatic instruction: An exploratory study. *Intercultural Pragmatics*, *12*(3), 333–362. https://doi.org/10.1515/ip-2015-0017.

Sydorenko, T., Jones, Z. W., Daurio, P., & Thorne, S. L. (2020). Beyond the curriculum: Extended discourse practice through self-access pragmatics simulations. *Language Learning & Technology*, *24*(2), 48–69. http://hdl.handle.net/10125/44725.

Sykes, J. M. (2013). Multiuser virtual environments: Learner apologies in Spanish. In N. Taguchi, & J. M. Sykes (Eds.), *Technology in interlanguage pragmatics research and teaching* (pp. 71–100). John Benjamins.

Sykes, J. M. (2018). Interlanguage pragmatics, curricular innovation, and digital technologies. *CALICO Journal*, *35*(2), 120–141. https://doi.org/10.1558/cj.36175.

Sykes, J. M., & González-Lloret, M. (2020). Exploring the interface of interlanguage (L2) pragmatics and digital spaces. *CALICO Journal*, *37*(1), i–xv. https://doi.org/10.1558/cj.40433.

Taguchi, N. (2015). Instructed pragmatics at a glance: Where instructional studies were, are, and should be going. *Language Teaching*, *48*(1), 1–50.

Taguchi, N. (2019). Second language acquisition and pragmatics: An overview. In N. Taguchi (Ed.), *The routledge handbook of second language acquisition and pragmatics* (pp. 1–14). Routledge.

Taguchi, N. (2021). Application of immersive virtual reality to pragmatics data collection methods. *CALICO Journal*, *38*(2), 181. https://doi.org/10.1558/cj.41136.

Taguchi, N. (2022). Immersive virtual reality for pragmatics task development. *TESOL Quarterly*, *56*(1), 308–335. https://doi.org/10.1002/tesq.3070.

Taguchi, N., Li, Q., & Tang, X. (2017). Learning Chinese formulaic expressions in a scenario-based interactive environment. *Foreign Language Annals*, *50*(4), 641–660. https://doi.org/10.1111/flan.12292.

Taguchi, N., & Roever, C. (2017). *Second language pragmatics*. Oxford University Press.

Tang, X. (2019a). Use of technology for learning second language pragmatics. *Applied Language Learning*, *19*(1 & 2), 52–72.

Tang, X. (2019b). The effects of task modality on L2 Chinese learners' pragmatic development: Computer-mediated written chat vs. face-to-face oral chat. *System*, *80*, 48–59. https://doi.org/10.1016/j.system.2018.10.011.

Tang, X., & Taguchi, N. (2020). Designing and using a scenario-based digital game to teach Chinese formulaic expressions. *CALICO Journal*, *37*(1), 1–22. https://doi.org/10.1558/cj.38574.

Tang, X., & Taguchi, N. (2021). Digital game-based learning of formulaic expressions in second language Chinese. *The Modern Language Journal*, *105*(3), 740–759. https://doi.org/10.1111/modl.12725.

Timpe-Laughlin, V., Dombi, J., Sydorenko, T., & Sasayama, S. (2023). L2 learners' pragmatic output in a face-to-face vs. a computer-guided role-play task: Implications for TBLT. *Language Teaching Research*. Advance online publication. Retrieved from https://doi.org/10.1177/13621688231188310. Accessed on 26 January 2025.

Timpe-Laughlin, V., Green, A., & Oh, S. (2021). Raising pragmatic awareness: A think-aloud study. *System*, *98*, 102470. https://doi.org/10.1016/j.system.2021.102470.

Usó-Juan, E. (2022). Exploring the role of strategy instruction on learners' ability to write authentic email requests to faculty. *Language Teaching Research*, *26*(2), 213–237. https://doi.org/10.1177/13621688211066997.

Vandergriff, I. (2013). "My major is English, belive it or not:)"—Participant orientations in nonnative/native text chat. *Calico Journal*, *30*(3), 393–409. http://www.jstor.org/stable/calicojournal.30.3.393.

Yang, L. (2024). Affording pragmatics-focused training for language teachers: The case of L2 Mandarin Chinese. *System*, *125*, 103447. https://doi.org/10.1016/j.system.2024.103447.

Young, R. (2011). Interactional competence in language learning, teaching, and testing. In H. Hinkel (Ed.), *Handbook of research in language learning and teaching* (pp. 426–443). Routledge.

Zhang, Y. (2022). The influence of practice contexts on L2 learners' compliment responses: Telecollaborative video-based practice versus face-to-face practice. *Computer Assisted Language Learning*, *37*(7), 2174–2201. https://doi.org/10.1080/09588221.2022.2152054.

Zhang, Y. (2023). The influence of game-enhanced communication on EFL learners' pragmatic competence in compliment responses. *Applied Linguistics*. Advance online publication. Retrieved from https://doi.org/10.1093/applin/amad082. Accessed on 26 January 2025.