

# Pre-Service Language Teachers' Perceptions and Applications of Generative AI for Future Teaching

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## Abstract

The rapid advancement of generative AI, along with other digital technologies, is drastically changing the needs of language learning students and teachers. This classroom-based exploratory study focused on pre-service language teachers in a professional development program and investigated their perceptions of ChatGPT's affordances, the competencies necessary to use ChatGPT effectively, and how they incorporate these affordances into their pedagogical task designs to foster those competencies, specifically in the context of academic writing. The study found that the pre-service teachers became less positive about ChatGPT's affordances after gaining more experience using it in their academic writing. The necessary competencies that they identified showed different patterns according to their own writing proficiency; those with lower proficiency primarily focused on evaluative competencies (cognitively higher-level competencies), whereas those with higher writing proficiency expressed more holistic views encompassing various levels of competencies, including basic language skills. However, the pre-service teachers, regardless of their proficiency levels, appeared to encounter difficulty transitioning from viewing the use of ChatGPT from a student's perspective to a teacher's perspective. Their pedagogical task designs reflected challenges in using ChatGPT *for* their students' learning, rather than *in* learning, which highlighted the need for fostering such pedagogical strategies in professional development programs.

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## **<sup>1</sup>Introduction**

The rapid advancements in generative AI, including ChatGPT, have revolutionarily changed the way we learn and work. Powered by natural language processing technology and big data analysis, ChatGPT is well known for its conversational capabilities and extensive dataset (Yu et al., 2024). It can not only generate human-like responses but also be tailored to meet the needs of specific applications across various contexts.

Despite the quick penetration of ChatGPT into daily life, its application in educational settings has been deeply controversial (Zhao et al., 2024). Opinions differ with respect to whether or not ChatGPT should be used in students' learning, and if so, when and how it should be used. Proponents of ChatGPT state that it can provide answers and information to complex questions in a prompt manner (Yu et al., 2024) and adapt to students' unique needs and styles to personalize learning (Dong et al., 2024). Easy accessibility is an additional advantage; one can access ChatGPT anytime and anywhere. Moreover, ChatGPT can be a helpful assistant for language teachers who often find it difficult to provide students with differentiated teaching in traditional classrooms (Slamet, 2024). Despite such potential merits, concerns have been raised regarding the accuracy and reliability of the information generated by ChatGPT as it may fail to correctly cite sources or even provide fabricated information and citations. Ethical issues have been discussed as well. For example, Lund and Wang (2023) argued that ChatGPT's response might violate users' privacy because it is capable of generating sensitive information without proper and explicit consent. The training data sources are also not openly declared, leading to the potential of containing bias and violating copyrights during the training process (Zhao et al., 2024). Most critically for educators, the prominence of ChatGPT in learning may negatively impact students' critical thinking skills because it provides ready-to-use answers, depriving students of opportunities to think independently (Kooli, 2023). Although these previous studies have addressed both the challenges and benefits of incorporating ChatGPT in language learning, how teachers should (or should not) adopt ChatGPT in their teaching is largely unsolved; there is still a lack of shared guidelines and frameworks to assist teachers in making pedagogical decisions.

To respond to such circumstances, the present exploratory study, conducted within a professional development program, aims to understand (1) how pre-service language teachers perceive ChatGPT's affordances and how their perceptions may evolve with experiences using it in their own academic writing; (2) how they conceptualize the competencies that their future students need to use generative AI effectively and appropriately in learning; and (3) what pedagogical tasks they believe will help students develop such competencies.

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The study was conducted as part of a larger project in which international pre-service language teachers engaged in a series of academic writing and pedagogical task-designing activities in a content class (Introduction to Educational Linguistics). Our overall goal for the larger project was to identify pre-service language teachers' needs, observe their transition from language learners to teachers, and incorporate their perspectives to improve our professional program (Butler & Jiang, 2025). Generative AI is transforming both the way we use language (i.e., *what* to develop) and how we learn and teach (i.e., *how* to develop). In the present study, we aim to understand both *what* and *how* to learn/teach from the pre-service teachers' points of view, which should yield practical implications for enhancing professional development programs in preparing teachers for AI-era language instruction.

## Background

### *Previous Research on ChatGPT in Second Language (L2) Writing*

With the advancement of technology, computer-assisted language learning has become an important area in L2 development since the 1980s. As Chapelle (2001) suggested more than 20 years ago, language learners in the 21st century are entering a new world where their communicative competence must include competencies associated with electronic communications. If technology has opened up new venues for language learning, then ChatGPT can be said to be a game-changer. Since its launch in 2022, researchers have explored various roles and applications of ChatGPT in language education (e.g., Chapelle et al., 2024; Kohnke, 2023; Xiao & Zhi, 2023; Yan, 2023). Among a wide range of applications, ChatGPT's potential for L2 writing has attracted special attention given its extensive database to generate texts and its affordance of offering instant human-like feedback (Nazari et al., 2021). Such existing studies can be characterized by three general trends, as discussed below.

The first trend focuses on students' perceptions of ChatGPT's affordances and their use in L2 writing. Existing studies found that ChatGPT can support distinctly at different stages of writing (Zhao et al., 2024). At the prewriting stage, learners tend to use ChatGPT to comprehend assignment questions, summarize articles and reports, brainstorm ideas, and organize writing structures (Xiao & Zhi, 2023). During the writing process, when language learners often face grammatical and lexical challenges (De Wilde, 2023; Sun & Wang, 2020), ChatGPT is found to be capable of resolving such challenges by correcting grammar, aligning students' writing with assignment questions, and providing proofreading support (Slamet, 2024). In an intervention study of college English as a Foreign Language (EFL) students' use of ChatGPT in L2 writing, Yan (2023) made use of ChatGPT's affordances to structure essays and ensure grammatical accuracy. ChatGPT's capability of providing formative feedback is also perceived by learners as a key affordance during writing activities (Steiss et al., 2024). In a mixed-methods study that explored 41 language learners' evaluation of ChatGPT, Žammit (2024) reported that learners benefited from ChatGPT's instant and personalized responses. By digesting

ChatGPT's feedback, learners demonstrated significant improvements in their vocabulary and comprehension. This discursive feature of ChatGPT appears to alter the writing workflow because learners can repeatedly evaluate ChatGPT-generated text until they obtain a satisfactory response (Yan, 2023). Since ChatGPT is available online, learners can practice their language skills beyond the temporal and spatial constraints of traditional classrooms, creating a portable and easily accessible learning environment (Haristiani, 2019).

The second trend in studies concerns language teachers' perceptions of ChatGPT and the competencies that they need to possess. The Technological Pedagogical and Content Knowledge (TPACK) framework—a theoretical model of the knowledge that teachers need to have in order to successfully integrate technology in their instruction (Mishra & Koehler, 2006)—has often been used in this line of research. By adopting the TPACK framework, Chapelle et al. (2024) conducted an exploratory study to investigate how six English language teachers from different countries used ChatGPT to develop reading and writing activities. The researchers found that, while teachers expressed general satisfaction with ChatGPT's ability to generate reading text and create writing assignments, their overall confidence level in using ChatGPT was only moderate. This suggests a potential lack of relevant generative AI knowledge and highlights the importance of developing teachers' technological and pedagogical skills to integrate generative AI into language teaching. Similarly, based on the TPACK framework, Urazbayeva et al. (2024) conducted a prompt-driven intervention study to examine in-service EFL teachers' perspectives on and the actual use of ChatGPT in English language education. After the 8-week intervention, researchers concluded that EFL teachers used ChatGPT at all teaching stages to target different language skills, including creating reading comprehension worksheets, designing speaking activities, introducing ChatGPT to students as a resource in the classroom, and assessing students' writing assignments. Despite their general satisfaction with ChatGPT in language teaching, teachers' pre- and post-intervention performance on the ChatGPT Integration Proficiency Assessment showed only statistically modest improvement. This aligns with Chapelle et al. (2024), underscoring the urgent need for extensive, well-designed professional development programs to strengthen language teachers' technological and pedagogical knowledge for effective ChatGPT integration.

The third trend mainly concerns the ethical issue of ChatGPT and the need to develop a thorough understanding of its mechanism. Dong (2024), in his study of 215 university L2 English learners' perceptions and usage behavior of ChatGPT in writing activities, found that participants tend to be cautious with using ChatGPT for academic writing because of the potential risk of committing plagiarism as well as the possibility of failing to develop proper cognitive and analytical skills. Steiss and his colleagues (Steiss et al., 2024) noted that ChatGPT's response should be selectively considered instead of taken up completely out of fallibility concerns. Therefore, they argued that both teachers and students should

develop an understanding of how AI works and its limitations, which should be a priority and prerequisite for the effective use of ChatGPT in language learning. Similarly, Hockly (2023) emphasized the need to understand AI tools' drawbacks and that a conscientious use of AI should be prioritized in order to mitigate the drawbacks. Kohnke et al. (2023) also pointed out that teachers and learners should develop specific digital competencies to maximize ChatGPT's affordances in learning activities. Teachers need to not only raise learners' awareness of the features and ethical issues of ChatGPT but also to guide learners on how they could use ChatGPT in self-directed learning. Taken together, these studies highlighted the importance of developing so-called AI literacy for both teachers and students. But what exactly is it?

### *AI Literacy*

Though AI literacy is not a brand-new concept, there is no agreed-upon definition among researchers; AI literacy has been defined differently depending on disciplines and purposes (Laupichler et al., 2022). Kandlhofer et al. (2016) proposed one of the first few definitions of AI literacy from the perspective of computer science education, primarily focusing on researchers and teachers. Just like the classical notion of literacy does not simply mean developing skills to read and write but empowers people by enhancing their understanding of how texts work, AI literacy should empower people to use technologies while helping them develop an understanding of the concepts behind AI products. According to Kandlhofer and his colleagues, AI literacy consists of several constructs including knowledge of basic computer science and algorithms. It should be noted that they used AI and computer science interchangeably, resulting in a blurred boundary between AI literacy and computer literacy. Other scholars argued that even though AI is a type of digital technology, AI literacy should be conceptualized more precisely, separated from general computer literacy (Wang et al., 2023). For example, instead of focusing on programming, coding, and technology-centric algorithms and logic, AI literacy is more concerned with social interaction and constructs such as one's use of social skills during the interaction are also considered important (Ng et al., 2021).

Long et al. (2021), one of the most cited sources on AI literacy, defined it as a set of competencies that allows users to communicate, collaborate, use, and critically evaluate AI technologies. They proposed sixteen competencies and fifteen design considerations to support the successful adoption of AI across various social domains. For instance, they suggested that users should recognize how computers reason, understand the steps in machine learning, develop data literacy, and recognize that computers use sensors to perceive and represent the world. While Long and her colleagues provided a detailed framework for AI literacy with strong theoretical foundations, its constructs and descriptions are too general and abstract to be readily applied in educational settings.

Since the present study aims to have pedagogical implications, a more pedagogical-oriented conceptualization of AI literacy such as Wang et al.'s (2023), would be more

suitable. Different from the definitions of Kandlhofer (2020) and Long et al. (2021) described above, Wang and colleagues emphasized the social importance of AI technology rather than focusing on specific digital skills and technology-related concepts. They defined AI literacy as the ability to comprehend, apply, and exploit AI technologies in order to proficiently accomplish tasks while critically analyzing and evaluating the information generated. Based on this conceptualization, they identified four main constructs: awareness, usage, evaluation, and ethics. Awareness refers to the ability to “identify and comprehend AI technology during the use of AI-related applications” (p. 1326). For example, users should be aware of how specific AI technology could help them accomplish the task. Usage means the ability to apply AI technologies to complete tasks efficiently and effectively. Evaluation is the ability to critically analyze and evaluate both AI technologies and the outcomes that they generate. Finally, ethics involves understanding the responsibilities and risks associated with using AI technologies.

Ng et al.’s (2021) review paper on AI literacy definitions proposed in previous studies revealed very similar constructs of AI literacy with Wang et al.’s (2023), which were composed of (a) know & understand, (b) use & apply, (c) evaluate & create, and (d) AI ethics. Additionally, Ng et al. pointed out that the skill and ability-based elements in their framework (namely, the first three abilities) can be potentially mapped onto Bloom’s taxonomy (Anderson & Krathwohl, 2001) in a hierarchical order. The awareness construct serves as the base and is captured by the action verbs *understand* and *know*. At this level, students should be familiar with AI concepts and explain the meaning of AI. Building on this, usage is in the middle and described by the action verb *apply*. Students are expected to apply AI technology effectively according to the context. At the upper levels are *analyze*, *evaluate*, and *create* that describe the evaluation construct. Students should be able to organize and decompose an AI problem, justify their decisions with AI applications, and ideally, construct and build AI applications. Critically, Ng et al. found that most of the studies that they reviewed concerned the first two aspects (know/understand AI and use & apply AI) but not how to foster students’ abilities to analyze and evaluate AI using high-order thinking. This may be, in part, due to the fact that the overwhelming majority of the papers were conducted at the K-12 school level in their review.

### **Research Questions**

In essence, previous studies have gradually uncovered students’ and in-service teachers’ perceptions of and use of ChatGPT’s affordances. However, we still lack a sufficient understanding of the specific support pre-service language teachers need as they transition from students to language teachers regarding the use of generative AI. More specifically, this study aims to explore how pre-service language teachers (international students enrolled in a Teaching English to Speakers of Other Languages [TESOL] program in the United States) reflect on their experiences using ChatGPT as students, map these experiences onto their future students’ target competencies, and translate them into

instructional strategy decisions on whether to use generative AI. Using academic writing instruction as an example context, this exploratory study aims to answer the following questions, applying Ng et al.'s (2021) model of AI literacy as an analytical framework:

**RQ<sub>1</sub>:** What affordances do international TESOL students (i.e., pre-service language teachers) identify and understand when they use ChatGPT for academic writing in their L2 as students? Do their perceptions of ChatGPT's affordances change after gaining more experience with it in academic writing?

**RQ<sub>2</sub>:** In order to use ChatGPT's affordances effectively and appropriately in L2 academic writing, what knowledge and skills (i.e., competencies) do these pre-service teachers believe their future students should develop? Are there any differences in their perceptions of such competencies based on their own writing proficiency?

**RQ<sub>3</sub>:** How do these pre-service teachers incorporate the use of ChatGPT's affordance in their pedagogical task designs to help future L2 students develop such competencies?

By answering these questions, we aim to understand these pre-service teachers' needs, which can potentially be incorporated into their professional development.

## **Methods**

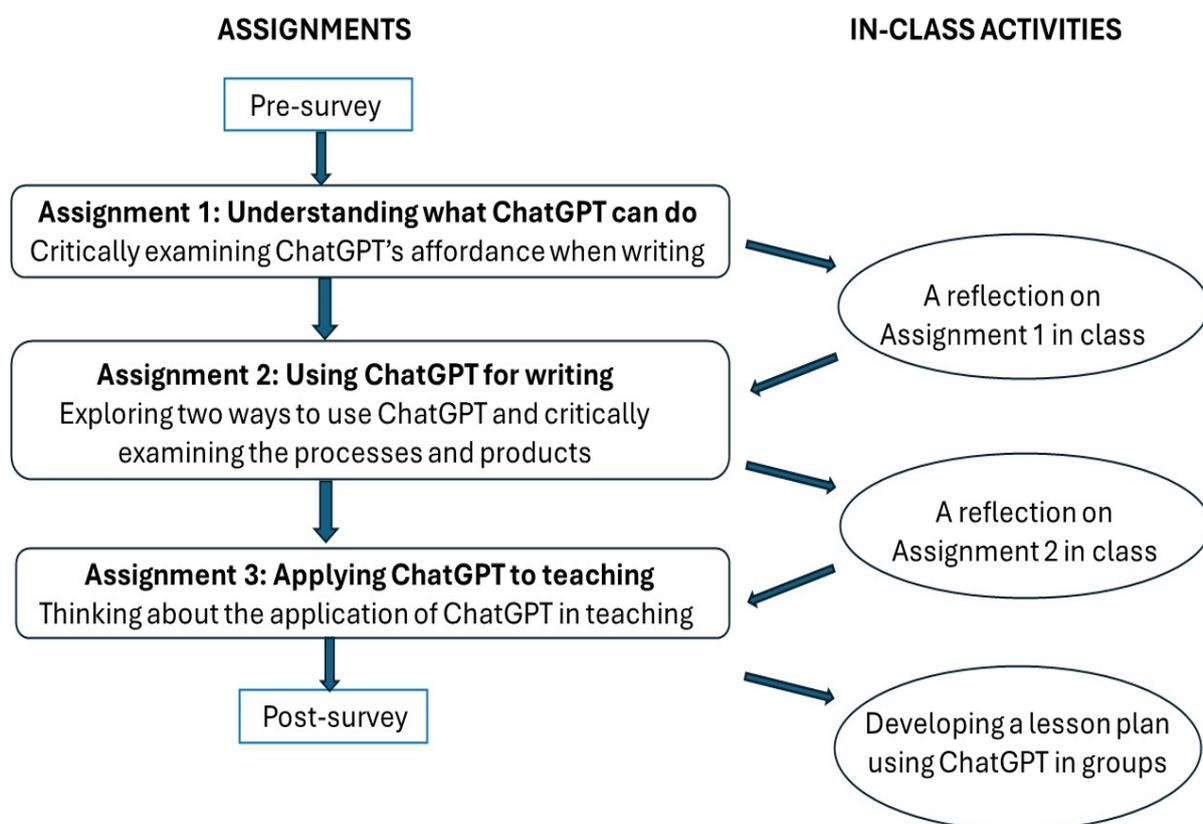
### *Research Context*

The present study was part of a larger action research project designed to understand pre-service language teachers' use of generative AI (ChatGPT in our case) and identify their needs as future teachers in the era of generative AI. The original project was undertaken in a content class (i.e., Introduction to Educational Linguistics) that was required for incoming pre-service TESOL teachers during the first semester in a professional development program at a graduate school of education in the United States. As part of the course requirements, the pre-service teachers were asked to complete three assignments, along with follow-up in-class activities related to the previous assignments (see Figure 1). In addition, they took two surveys that were designed to obtain background information (Pre-Survey) and reflect on the entire project experience (Post-Survey).

In the first two assignments, the pre-service teachers engaged in writing activities as users of ChatGPT as graduate students. In Assignment 1, they wrote two short literature reviews on the same given topic, first without using ChatGPT and second asking ChatGPT to generate the review. The participants compared the writing processes and products of the two literature reviews and critically discussed the potential and limitations of ChatGPT's affordances in academic writing in L2. Their self-written literature reviews were also graded by the course instructors, who provided both numerical scores and written feedback. Because the pre-survey indicated that two major ways for the participants to use ChatGPT in writing were (a) to generate ideas and (b) to revise their essays (see below), we asked them to explore these two ways in Assignment 2. They

wrote two essays on different topics, using ChatGPT as an ideal generator in one essay and as a revision assistant in another essay. Again, the participants reflected on the two ways of using ChatGPT in academic writing and critically discussed ChatGPT's affordances (in 400 words). After each assignment, the participants discussed their reflections in class as part of in-class activities. In Assignment 3, the participants were asked to wear teachers' hats, rather than graduate students' hats, and to write a short essay in 400 words regarding (1) what they thought competencies necessary for their future students to use ChatGPT effectively and appropriately; and (2) how to use ChatGPT (or not to use ChatGPT) as a TESOL teacher for a hypothetical academic writing course for post-graduate students. In the subsequent class activity, the pre-service teachers designed a writing task for the same hypothetical students (English learners at the post-graduate level) using ChatGPT in groups of 4-5. They presented their plans and discussed the effectiveness and appropriateness of their designs with the whole class. Each group submitted their task plans to the instructor (the first author), consisting of descriptions regarding: (1) target competencies to develop; (2) task objectives; (3) target students and their characteristics; (4) materials; (5) task procedures; (6) feedback (if already planned); (7) the ways of using ChatGPT; and (8) rationale for using ChatGPT. The entire process took five weeks altogether.

**Figure 1**  
*Procedures of the Original Project*



Note: Adapted from Butler and Jiang (2025, p. 4).

*Participants*

Thirty-eight international pre-service TESOL teachers who enrolled in the class participated in this study. (The class had only international participants.) Almost all of them, except one, had no or little teaching experience before joining the program. The majority of the students spoke Chinese as their primary language, except for two students: one spoke Japanese and the other spoke Vietnamese.

Since the study was conducted in the fall of 2023, the participants had moderate experience of using ChatGPT or any other generative AI. According to the pre-intervention survey (Pre-Survey), 76% of the participants (29 out of 38) had used ChatGPT (or any other generative AIs) for academic purposes “occasionally”, 13% (5 out of 38) used it “approximately a half the academic work”, and 11% (4 out of 38) had never used it. Among those who used ChatGPT, the two most common uses were “grammar checks” and “generating ideas”, followed by “translating” and “summarizing”.

Their preliminary impression of ChatGPT before the intervention was that ChatGPT would increase the efficiency of their academic studies but not necessarily the quality of their work. A majority of them (22 out of 38, 58%) responded that ChatGPT would have a positive impact on L2 students’ academic writing in general. When the study was conducted (the fall of 2023), none of the participants, except one, had used ChatGPT 4.0; therefore, the entire project was conducted using Version 3.5.

*Analysis*

A series of analyses were employed in order to answer the research questions, as shown in Table 1. The participants’ essay responses were analyzed both qualitatively (a thematic analysis) and quantitatively (frequency accounts based on coding).

Epistemic Network Analysis (ENA) is an analytical technique that examines relationships among coded qualitative data using network models (Shaffer et al., 2016, p. 9). It not only models how different codes are connected, but also visualizes differences between comparison groups. By using dimensional reduction techniques, ENA highlights the most important variations along the x- and y-axes, and positions networks on opposite sides of the x-axis if the groups being compared show statistically significant differences. We employed ENA to explore interrelationships among the participants’ perceived language-related competencies (Q2).

Initial coding categories for both affordances and competencies were identified based on a random selection of several essays from each assignment, with two researchers collaborating on the process. Two additional research assistants were trained to code the remaining data. When discrepancies occurred, final decisions were made through discussions between one researcher and the research assistants.

**Table 1**

*Analyses Performed*

	Target Questions	Data Used	Analyses Employed
Q1	The participants' perceptions (and changes of perceptions) of ChatGPT's affordances as they write academic essays as students	Critical reflections (in an essay format) for both Assignments 1 and 2.	While consulting previous studies, a thematic analysis was conducted in a bottom-up fashion, initially using the reflections from Assignment 1. (See also Butler and Jiang [2025] for details to develop the initial coding for Assignment 1.) The coding was triangulated using participants' reflections in Assignment 2; their articulated affordances of ChatGPT were coded and compared with the results from Assignment 1.
Q2	The participants' conceptualizations of the target competencies for their future students	Essay written in Assignment 3	Following previous studies' categorization of AI literacy, language-related skills and knowledge were identified and coded. Interrelations among perceived competencies were explored using Epistemic Network Analysis (ENA).
Q3	The participants' plans for using ChatGPT as a teaching tool	Essay written in Assignment 3; task plans in a class activity	Targeted competencies in their essay in Assignment 3 and task plans were qualitatively examined, while paying attention to the consistency between the targeted competencies, the roles of ChatGPT in tasks/instruction, and the provided rationales.

**Results**

*RQ1: The Participants' Perceived ChatGPT's Affordances after Completing Two Writing Assignments as Students*

Three themes emerged from the students' observations of ChatGPT's affordances: content, organization, and language. Under each theme, identified affordances were classified as either positive or negative ones. Table 2 lists all the affordances with definitions, along with some example quotes from the participants. Figure 2 indicates the raw frequencies of each affordance mentioned by the participants after Assignment 1 (explored what ChatGPT could generate and compared their own writing) and Assignment 2 (used ChatGPT to write academic essays in two different ways).

**Table 2***Coding Scheme (Adopted from Butler & Jiang, 2025, p. 5)*

Themes	Positive vs. Negative	Codes	Definition	Example from the Dataset
1 Content	1.1 Positive	p. efficient	This refers to participants' perception of ChatGPT's ability to quickly generate responses in a few seconds.	"ChatGPT has the ability to rapidly generate a preliminary framework to facilitate subsequent refinement, proving particularly beneficial in the preliminary stages of content creation. This can help save a lot of time." (ID 4)
		p. coherence	This refers to participants' perception that ChatGPT's response is logically connected and consistent throughout the paragraph(s).	"I didn't use any subtitles to organize my content, which made my version worse than that by ChatGPT regarding coherence." (ID 25)
		p. completeness	This applies to ChatGPT's perceived ability to offer a holistic and informative view of the area/field.	"The article provided by ChatGPT contains more sections and analyzes this prompt from a more multidimensional perspective." (ID 26)
		p. quality	This refers to participants' perception that ChatGPT's response contains a good amount of analysis.	"Although the writing format of ChatGPT is similar to mine, its content and statements are much richer." (ID 27)
		p. information	Among the subcodes, completeness refers to how well ChatGPT's response completes the given prompt, which relates to the presentation of information in the dataset. Credibility is included because the single participant who used this term referred to ChatGPT's ability to gather background information.	"ChatGPT is superior in terms of concise and precise summarization, and it clearly gathers information and writes much faster than humans." (ID 20)
	1.2 Negative	n. coherence	This refers to participants' perception that ChatGPT's literature review is not cohesive because it lacks a connection among the studies it discusses.	"ChatGPT repeats key words in the prompts without establishing logical connections between sentences." (ID 10)
		n. citation	This refers to cases when the citations used by ChatGPT are perceived as inappropriate or irrelevant.	"I also found that the in-text citation that appeared in his article was not in the reference. I think this will make readers feel strange and confused." (ID 21)
		n. completeness	This points to the limited extent to which ChatGPT completes the prompt.	"I asked ChatGPT to use the reference format of the 7th APA format, but it did not give the correct format. In addition, I asked it to give a literature review of about

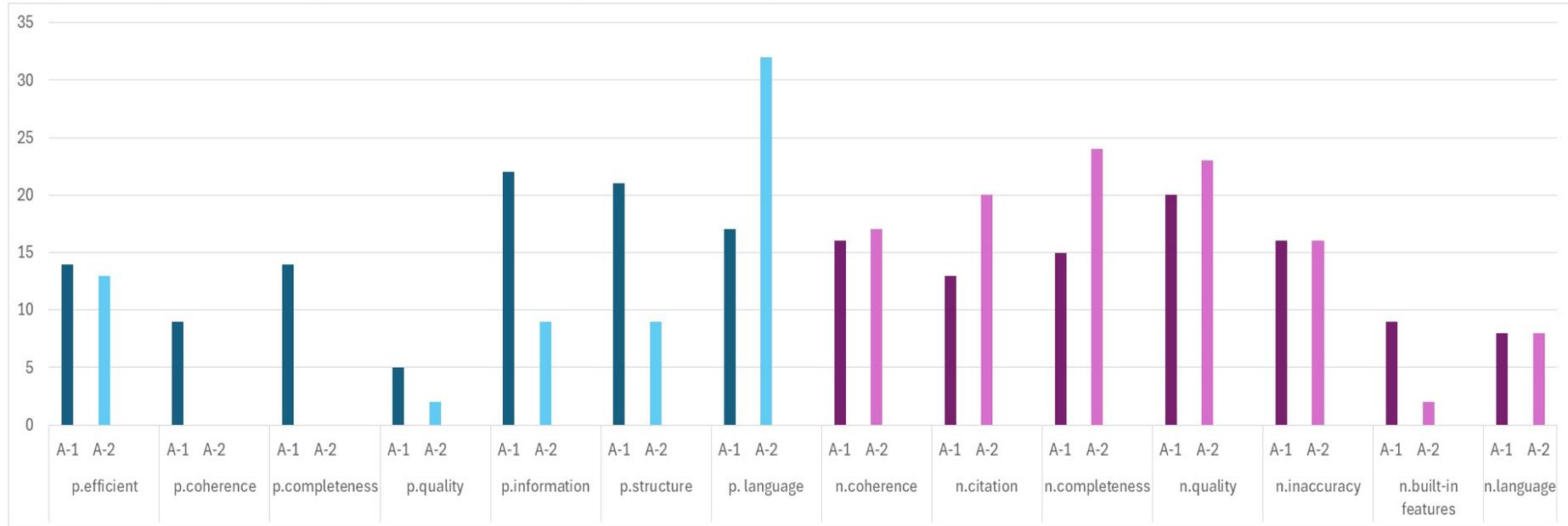
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		n. quality	This refers to quality-related negative perceptions (such as superficial arguments and oversimplified writing) and also meta-level perceptions (such as critical thinking and creativity).	750 words, but when I used it for the third time, it only wrote more than 500 words." (ID27) "However, I think its summarization of all the findings supporting or criticizing CPH is too brief. It does not explain ideas in depth and sometimes oversimplifies complex arguments." (ID 24)
		n. inaccuracy	This refers to the perception that ChatGPT's response may contain inaccurate information. This includes cases when ChatGPT refers to the appropriate scholarly work, but the summarization of that work does not match the actual content.	ChatGPT also randomly twists the author's views and standings in trying to round up a "story" or generalization in support of its own views, which is the most dangerous trait of all." (ID 5)
		n. built-in features	This refers to ChatGPT's built-in features that participants perceived as having negative effects.	"Concerns concerning the model's accuracy and currency are also raised by the fact that it depends on an outdated database, particularly for tasks that call for current data." (ID 22)
2 Organization	2.1 Positive	p. structure	This refers to participants' perception that ChatGPT is able to clearly organize the response and structure it in a way that is easy for readers to follow.	"Compared to my work, ChatGPT's literature review is better structured with clearer logic." (ID 6)
3 Language	3.1 Positive	p. language	These are language-related positive perceptions such as word choice and grammar checks.	"Its language use and word choice are concise and accurate while mine is sometimes redundant and ambiguous." (ID 6)
	3.2 Negative	n. language	In contrast to P. Language, this code refers to participants' perception that ChatGPT's language use is not suitable for academic works.	"The word choices are too vague and general, such as "their empirical evidence" and "a certain point," which can be used to describe any scientific paper." (ID 31)

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**Figure 2**

*Frequencies of ChatGPT's Affordances Mentioned after the Two Assignments*



Note: A-1 and A-2 in the figure refer to the participants' responses after Assignments 1 and 2 respectively.

At first glance, overall frequencies on negative affordances were higher than positive ones; the total raw frequencies of positive and negative comments (both Assignments 1 and 2 combined) were 167 and 207 respectively. Although we don't have neatly parallel categories for positive and negative comments, with respect to completeness and quality, the negative ones were more frequently addressed than the positive ones.

Regarding the changes in frequency after Assignment 2, the remarks on positive affordances generally appear to decrease, whereas ones on negative affordances appear to increase (except for Positive language). It is notable that no participants mentioned Positive Coherence and Positive Completeness after Assignment 2. A series of McNemar's tests was performed to examine if there were indeed significant changes in the behaviors after Assignment 2. With respect to positive affordances, the results indicated significant decreases in the following affordances: Positive Coherence,  $\chi^2(1, N = 38) = 7.11, p = .004$ ; Positive Completeness,  $\chi^2(1, N = 38) = 12.07, p = .001$ ; Positive Structure,  $\chi^2(1, N = 38) = 8.64, p = .002$ ; Positive Information,  $\chi^2(1, N = 38) = 11.08, p = .001$ . Exceptionally, the response frequency increased in Positive Language,  $\chi^2(1, N = 38) = 10.32, p = .001$ . Regarding the negative affordances, significant changes were not observed in any affordances after Assignment 2, except in the Negative Build-in-feature,  $\chi^2(1, N = 38) = 4.00, p = .04$ .

In essence, the participants generally addressed more negative affordances than positive ones overall. Moreover, the frequency of addressing positive affordances dropped after the second assignment (in which they had more opportunities to use ChatGPT in specific ways in academic writing), except for Language affordances such as word choices and grammar checks. While many participants acknowledged ChatGPT's usefulness for basic language functions (and more strongly recognized its merits after the second assignment), they also simultaneously noted its limitations, such as inappropriately changing tones, deleting citations, and altering main arguments, as exemplified by the following quote:

*"Based on the revised one, I noticed that the ChatGPT might not fully understand the specific requirements of the essay I wrote even though I demonstrated them in the prompts... it sometimes made changes that did not align with the intended tone or style I aimed for. For example, it changed the way that I used to cite the sources in the text and added specific references to the works of scholars in the conclusion session which I think is unnecessary." (ID 24)*

*RQ2: Perceived Necessary Competencies for Academic Writing in the Era of AI Technology*  
As mentioned in the literature review section, in Ng et al.'s (2021)'s and Wang et al.'s (2023) AI literacy models, language-related competencies necessary for the era of digital literacy consisting of (a) knowing and understanding; (b) using and applying; (c) evaluating and creating; and (d) concerning ethics. A thematic analysis was performed on

the participants' essays on their language-related competencies and eight competencies were identified. These competencies were grouped based on the three elements in the AI literacy models above. The ethics element was excluded because no participants addressed ethical issues in the present study, primarily due to the nature of the task, which instructed students to use ChatGPT in specific ways. The result was summarized in Table 3, along with raw frequencies (i.e., the number of participants who mentioned each competence).

In order to examine the interrelationships among these competencies, Epistemic Network Analysis (ENA) was employed. As previously mentioned, ENA allowed us to analyze relationships among coded qualitative data (i.e., competencies) using a network model. (See also Butler and Jiang [2025] for more information on the use of ENA in this project.) We first examined the general tendency among all the participants. As shown in Figure 3, critical thinking skills, metalanguage skills, basic language skills, and prompting skills represent four pillars in pre-service TESOL teachers' conceptualization of target language-related competencies for their future students. The size of the nodes indicates the frequencies of each competency mentioned. The thicker lines show stronger connections between the competencies.

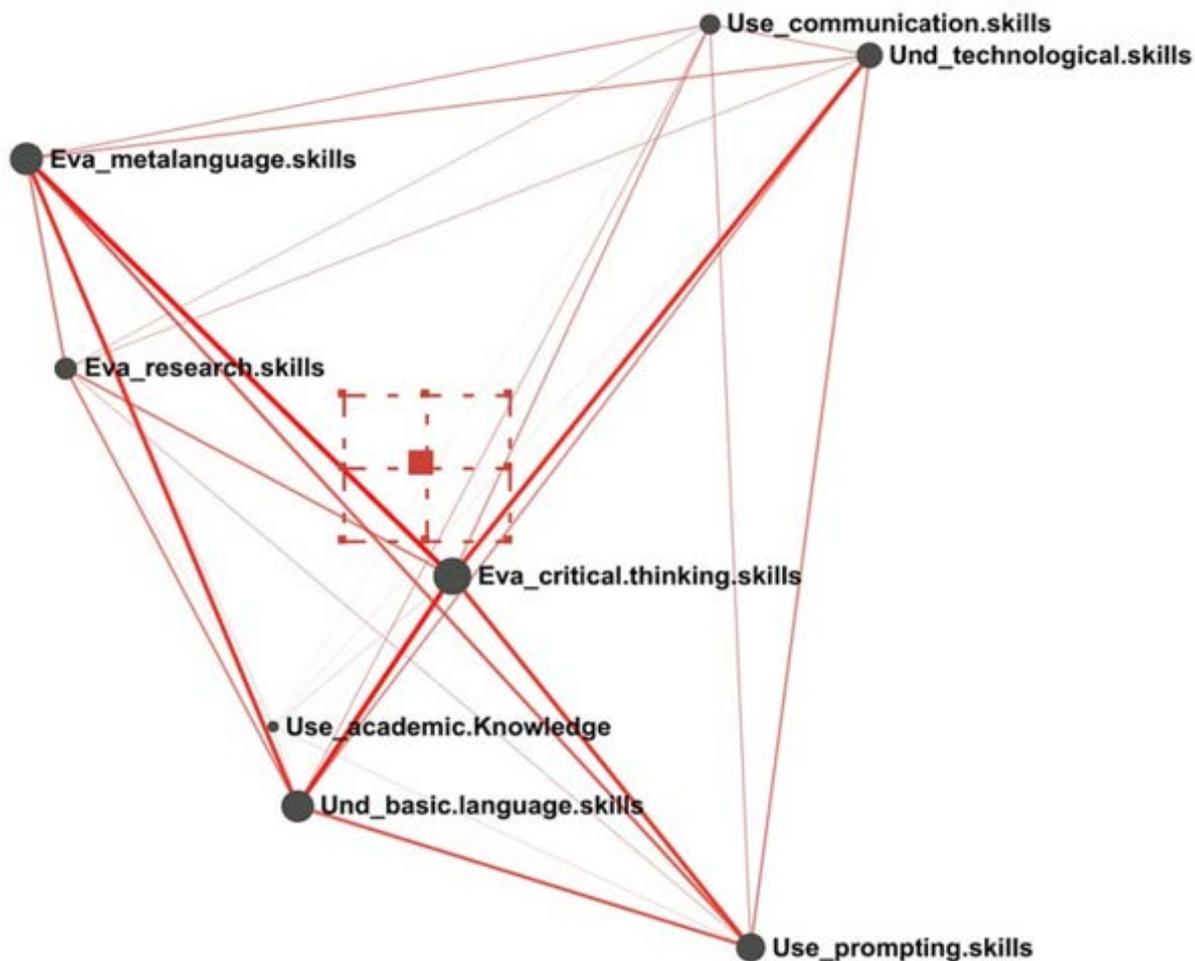
Critical thinking skills and metalanguage skills demonstrated the strongest co-occurrence (connection weight of 0.22), followed by critical thinking skills and basic language skills (0.21). Moderate connections were found between metalanguage skill and basic language skill (0.19), critical thinking skill and prompting skill (0.18), and critical thinking skill and technological knowledge (0.18). Prompting skills demonstrated an equal weight of connection with both basic language skills and metalanguage skills (0.15). All other connections were relatively weak (below 0.10) in this dataset. This suggests that pre-service TESOL teachers in general perceived an intertwined co-existence of competencies, with critical thinking skills playing an essential role.

**Table 3**

*Language-Related Competencies Perceived by Participants*

Corresponding AI Literacy	Competencies Related to Academic Writing	Definition	Example (Unedited Quotes from the Participants)	Frequencies Mentioned (%)
Evaluate	Critical thinking skills	Judge the accuracy, validity, credibility, overall quality, and degree of fitness of ChatGPT's response.	"Critical mind to filter what ChatGPT feeds them for the 'believable' part and to pick and thread meaningful studies or research provided by ChatGPT in a clear and logical manner." (ID 5)	84.2% (32 out of 38)
	Meta-language skills	Use meta-linguistic skills and knowledge to critically evaluate ChatGPT's writing and make modifications accordingly.	"Students must possess the ability to choose appropriate words and sentence patterns according to different contexts so that they can judiciously accept ChatGPT's suggestions." (ID 36)	73.7% (28 out of 38)
	Research skills	Collect and provide relevant and appropriate information for ChatGPT. Conduct further research based on ChatGPT's response.	"They should not blindly follow any advice or opinion given by the GPT but should obtain evidence from multiple sources to ensure that the information is authoritative and credible." (ID 15)	42.1% (16 out of 38)
Use	Academic knowledge	Possess basic academic (subject) knowledge to help students make informed choices when adapting ChatGPT's response	"Moreover, only when students have acquired fundamental knowledge of a topic can they evaluate ChatGPT's answer and take advice selectively." (ID 36)	13.2% (5 out of 38)
	Prompting skills	State needs and expectations concisely and precisely in prompts	"Clear and detailed questions are essential for ChatGPT to provide targeted answers as required." (ID 27)	60.5% (23 out of 38)
	Communication skills	Use appropriate language and language expressions to communicate with ChatGPT. Deliver needs clearly and in detail in different contexts and for different purposes.	"Students (especially L2 students) should have communicative competence, especially sociolinguistic competence and discourse competence, which means they can use language appropriately according to the context as well as to construct more coherent contexts." (ID 20)	36.8% (14 out of 38)
Understanding	Technological knowledge	Understand ChatGPT's potential, limitations, strengths, and weaknesses	"The ability to use the tool, to fully understand ChatGPT, including its advantages and disadvantages." (ID 26)	50.0% (19 out of 38)
	Basic language skills	Possess basic language skills to compose their original draft and comprehend ChatGPT's response.	"An advanced enough composition ability is required...It asks the student to have advanced composition ability to make sure they can finish the first draft by themselves and can notice its shortage compared to the revised version made by ChatGTP." (ID 33)	68.4% (26 out of 38)

**Figure 3**  
*Interrelations Among Identified Competencies for Academic Writing (All Participants' Responses Combined)*



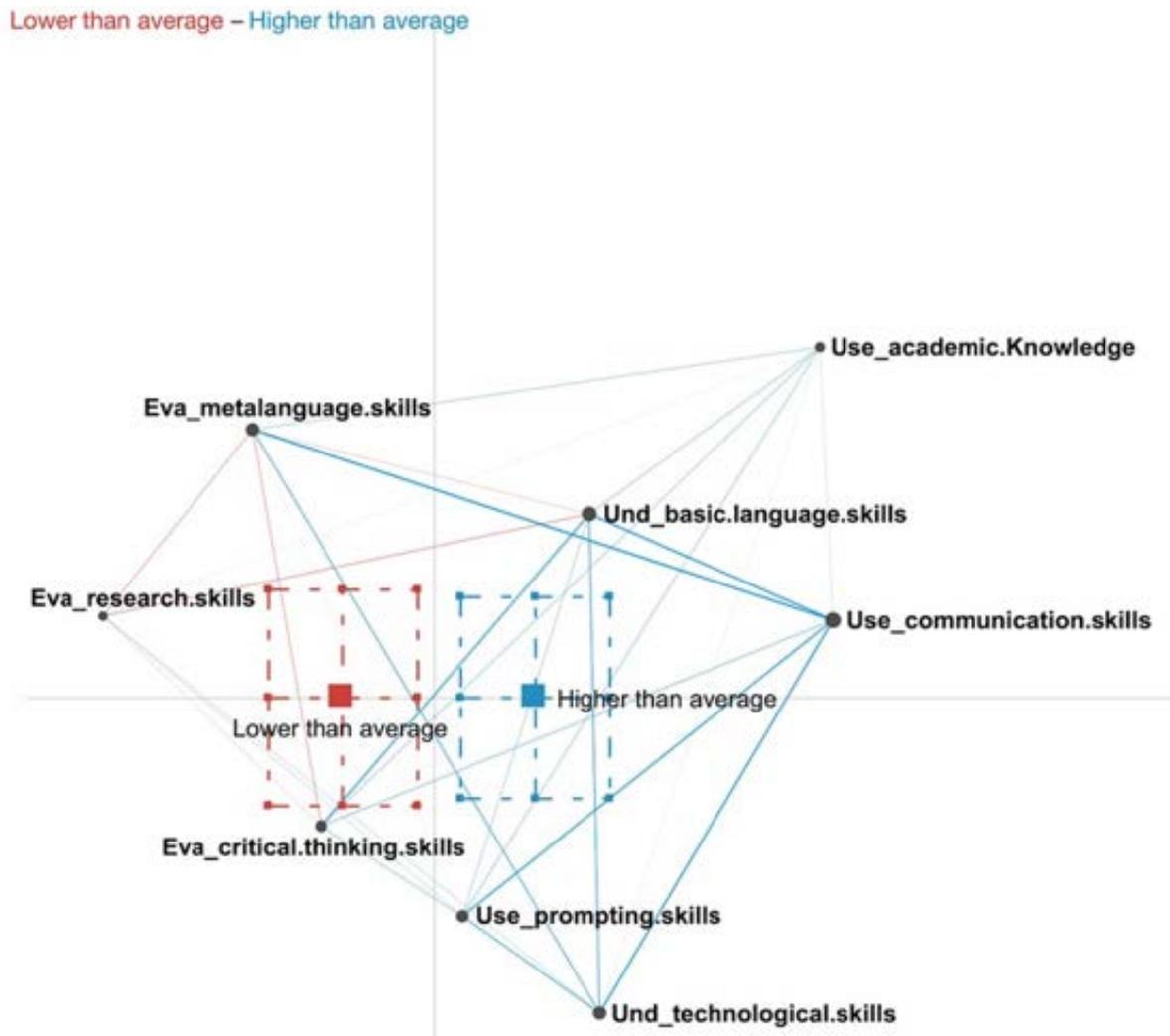
Next, we ran ENA again to compare the competencies that participants perceived as necessary for the AI era, categorized by their own writing proficiency level. The participants were divided into two groups based on the writing scores on Assignment 1 received by the instructor: the Higher-than-average group and the Lower-than-average group.

As shown in Figure 4, the network of the lower-than-average group is located on the left side of the x-axis, while that of the higher-than-average group is located on the right. Their 95% confidence intervals (represented by the two dotted boxes in the figure) do not overlap, indicating a statistically significant difference between the networks of the two comparison groups. Along the x-axis, a Mann-Whitney test showed that the lower-than-average group (median =  $-.16$ ,  $N = 20$ ) is statistically different from the higher-than-average group (median =  $.15$ ,  $N = 18$ ,  $U = 66$ ,  $p < .001$ ,  $r = .63$ ). The lower-than-average group predominantly focuses on evaluative competences (Metalanguage skills, Research skills, and Critical thinking skills) that were clustered on the left side of the x-axis. In contrast, the higher-than-average group's identification of competencies is more evenly

distributed across all three elements (i.e., evaluation, use, and understanding) in Ng et al.'s (2021) AI literacy model.

**Figure 4**

*Competencies for Academic Writing Identified by Pre-Service Teachers Based on Their Own Writing Performance*



*RQ3: The Participants' Planned Applications of ChatGPT in Their Teaching of Academic Writing*

The participants' individual and group task plans revealed challenges in making a coherent relationship between their goal statements (target competencies) and their use of ChatGPT in task design, based on their perceived affordances of ChatGPT. Such challenges were particularly notable in three skill domains: basic language skills, prompting skills, and critical thinking skills. More precisely, the challenges include (1) uncertainty about the role of basic language skills, and (2) vague plans for guiding the development of prompting and critical thinking skills.

### *Uncertainty about the role of basic language skills*

The first pattern that we observed in the pre-service teachers' lesson plans is their uncertainty about the role of basic language skills in the era of AI technology. Among 38 pre-service teachers, seven of them (18%) did not even wish to use ChatGPT in their L2 writing class in the first place because using ChatGPT would deprive students of opportunities to develop basic linguistic skills. For example:

*"Writing is a comprehensive task that tests a student's mastery of grammar, the construction of the structure of the essay, the precision of the word usage, and the logic of the whole text. ... Once they [=the students] use the ChatGPT, they will become too dependent on this excellent AI which causes their own writing skills are not developing." (ID 15)*

Correspondingly, among those who intended to use ChatGPT in their writing classes, 84% of them (26 out of 31) appeared to consider basic language skills as a prerequisite for students and made task plans based on the assumption that they already had developed such skills prior to using ChatGPT. For example, having learners compose a draft independently before using ChatGPT seems to be a commonly adopted practice among pre-service TESOL students, as exemplified below.

*"I will ask students to explore the editing function of ChatGPT by letting them input their composition and ask ChatGPT for revision." (ID 8).*

In order to make such tasks workable, students were assumed to have the ability to compose academic essays at a certain level. This assumption may be influenced by the hypothetical teaching context—namely, an academic writing course for postgraduate students. Interestingly, however, our pre-service teachers, including those with higher writing proficiency (i.e., those who tended to emphasize basic language skills as an important competency, as found in the analysis for Q2 in the previous section), appeared to have no specific plans for using ChatGPT to help their future students develop basic language skills, or as indicated in the quote above (ID 15), some expressed reluctance to use ChatGPT with students who had not yet acquired those foundational skills.

### *Vague plans for providing guidance for developing prompting and critical thinking skills*

Similar to the first pattern, the second notable pattern that emerged from the data was the participants' relative lack of clear pedagogical plans for helping their students develop skills in making effective prompts. When participants wore students' hats (when working on Assignments 1 and 2), approximately 40% (15 out of 38) of them identified prompting as the biggest challenge in using ChatGPT. Yet, when putting on teachers' hats and designing pedagogical tasks, pre-service TESOL teachers did not seem to have a clear picture of how to support their students' prompting skills. For example, ID 24 stated that "[I] would assist my students in formulating different prompts in English to get more

relevant and useful responses” without providing details on how students would be assisted. As discussed below, this may relate to their own lack of confidence and skills in making effective prompts.

A similar pattern was also observed with respect to critical thinking. Among the participants, critical thinking skills were conceptualized as the central competency for academic writing in the era of AI technology (refer to Figure 3). When the participants worked on academic writing as students (worked on Assignments 1 and 2), 45% (17 out of 38) identified critical thinking skills as *the biggest* challenge. However, hardly any task plans that they developed contained clear strategies for fostering their students’ critical thinking. Below is a typical example task design targeting to foster students’ critical thinking.

**Table 4**

*A Task Design Example Created by a Group of Pre-Service Teachers (A Summary of the Original Plan)*

Target competencies that you want your students to foster through this task	Critical Thinking
Task objectives	(1) Write an argumentative essay (2) Use evidence effectively to support arguments
Target students	Post-secondary, intermediate/low L2 proficiency; Chinese students
Materials	Topic: Whether or not human beings will be replaced by robots in the workplace in the future? Two papers representing different views on the topic
Procedures	(1) Brainstorm the topic independently (2) Ask ChatGPT to generate key arguments on the topic (3) Work as a pair and communicate with ChatGPT to refine the arguments (4) Read papers and identify relevant evidence (without using ChatGPT) (5) Write down the arguments and supporting evidence in a logical way (6) Proofread the writing and ask ChatGPT to make the writing more persuasive. Examine what ChatGPT changed.
The rationale for using ChatGPT	(1) By using ChatGPT, the students can expand their ideas (ChatGPT can provide the students with more ideas) (2) Since the students brainstorm ideas before using ChatGPT, they can avoid over-reliance on ChatGPT. (3) ChatGPT can generate more meaningful and constructive ideas and suggestions than peers; thus, it is better to discuss ideas generated by ChatGPT rather than those by their peers

Admittedly, the present study was conducted during the first semester of the professional development program, and these pre-service teachers had limited experience in developing or implementing pedagogical tasks in actual classrooms. However, the plan clearly shows that the task was not designed to help students develop a critical eye for evaluating what ChatGPT generates. Instead, as their third rationale exemplifies, the hypothetical students would be asked to learn from the arguments generated by ChatGPT, based on the assumption that they are "meaningful" and "constructive".

## Discussion

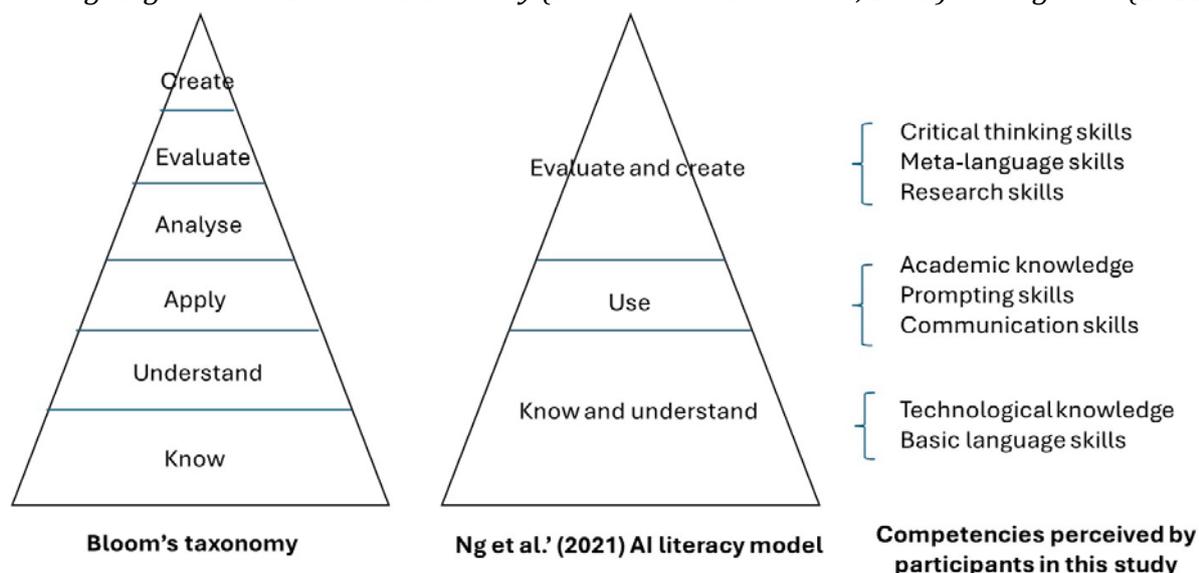
Pre-service TESOL teachers are a unique population as they transition from students to teachers. One can expect that their perceptions and use of ChatGPT in language learning and teaching may provide valuable insights for teacher preparation programs. This exploratory study, therefore, aimed to understand how pre-service TESOL teachers perceive ChatGPT's affordances, conceptualize the competencies that would be necessary to use ChatGPT effectively, and incorporate its affordances into task designs to help their students develop these competencies, with academic writing as a context.

The results indicated that our pre-service TESOL teachers addressed a range of ChatGPT's affordances in academic writing, though they had not yet made extensive use of ChatGPT in academic contexts when the study was conducted. After gaining some more opportunities to use ChatGPT in academic writing as students, their positive observations on ChatGPT's affordances diminished, particularly affordances related to content generation, while they increasingly emphasized its language-related functions (e.g., vocabulary and grammar checking). This suggests the value of including experiences of strategic ChatGPT use in professional programs.

The pre-service teachers also identified several competencies necessary for effective ChatGPT use in academic writing, with critical thinking at the center of them all. Importantly, however, the pre-service teachers showed varied degrees of emphasis on competencies according to their own academic writing proficiencies. As mentioned earlier, our coding was developed based on Ng et al. (2021), which, in turn, corresponds to Bloom's taxonomy (Anderson & Krathwohl, 2001) (see Figure 5). Our data revealed that pre-service teachers with relatively lower writing proficiency primarily focused on evaluative competencies—critical thinking skills, metalanguage skills, and research skills—all of which are considered cognitively demanding according to Bloom's hierarchical taxonomy and Ng et al.'s (2021) AI literacy model. In contrast, those with higher writing proficiency demonstrated more holistic perspectives and made connections across competencies at all three levels of Ng et al.'s model (see Figure 4). In our previous analysis of the pre-service teachers' initial attitudes toward ChatGPT (Butler & Jiang, 2025), we found that those with lower writing proficiency tended to view ChatGPT more positively, particularly appreciating its language-related functions such as grammatical accuracy and appropriate lexical choice. When combining that finding with the present study's results on necessary competencies, one might speculate that lower-proficiency teachers place greater value on the final written product than on the writing process itself. With strong evaluative competencies, a user can employ ChatGPT to produce a 'polished' essay without making efforts to write a solid initial draft or undergoing the often tedious process of editing and proofreading.

**Figure 5**

*Coding Aligned with Bloom's Taxonomy (Anderson & Krathwohl, 2001) and Ng et al. (2021)*



However, transitioning from viewing the role of ChatGPT in academic writing as students to seeing it as teachers was not easy. The pre-service teachers showed uncertainty about the role of basic language skills in their lesson plans. Most plans assumed that students already possessed basic language skills before using ChatGPT, while some even excluded the use of ChatGPT altogether, arguing that heavy reliance on it could hinder students' development of fundamental language skills. Whether ChatGPT deprives learners of opportunities to develop L2 writing skills until they reach a certain level of proficiency remains an empirical question; one might speculate that the answer depends on factors such as learners' age, experience with ChatGPT in their L1, instructional contexts, and so on. Similar practical challenges were also observed with respect to critical thinking skills. Although the majority of the participants expressed that critical thinking was the greatest concern as learners, their lesson plans were not designed to effectively foster these skills. It seems that pre-service teachers, regardless of their own writing proficiency level, need practical guidance on how to help future students develop basic language skills as well as critical thinking skills in AI-facilitated writing.

Another area that the pre-service teachers seem to need is prompting skills. The pre-service TESOL teachers tended to give relatively less attention to prompting skills in their task plans, despite the fact that most of them found prompting challenging in their own writing assignments. The reason for this mismatch was not entirely clear; however, it may reflect that pre-service TESOL teachers did not consider developing students' prompting skills as part of a language teacher's responsibilities. Alternatively, this misalignment might be due to pre-service TESOL teachers' perceived lack of sufficient prompting skills themselves, as participants reported relatively limited experience with ChatGPT in academic contexts prior to the study and in fact, demonstrated less developed prompting skills in Assignments 1 and 2. If prompting skills are indeed critical for the effective use

of generative AI, as proposed by Korzyński et al. (2023), and if teachers are expected to develop higher levels of prompting skills to teach them, professional development programs will need systematic support to ensure that future teachers reach a comfortable level of prompting proficiency in academic settings.

In general, the pre-service teachers in this study had difficulties making use of ChatGPT affordances effectively as teaching tools. In their task plans, justifications for why and how ChatGPT should be incorporated to facilitate aimed competency development were generally weak; the connection between ChatGPT's affordances and student learning was not straightforward. It appears that they designed learning activities with the mindset of using ChatGPT *in* language learning, rather than *for* language learning. Without a purposeful design for ChatGPT-incorporated learning, it is unlikely that students will achieve the intended competency development. Focusing on this aspect—using generative AIs *for* language learning—seems to be a particularly important focus in professional development for these pre-service teachers.

This study has some limitations. First, it was conducted in a specific context with a specific group of participants. Pre-service language teachers are by no means homogeneous. More studies are needed to closely examine teachers' perceptual and behavioral changes across different programs and groups of pre-service teachers. Second, as AI technology advances rapidly and as people's way of using it evolves, the needs of pre-service teachers may change quickly, both within the same group and across different cohorts. Since pre-service teachers in our program experience a year-long teaching practicum during the second year, we are planning to follow up with the same participants to examine whether their perceptions and practices change as they gain more hands-on teaching experience.

Last but not least, due to the nature of the writing tasks we asked participants to respond to, we were unable to obtain information about their perceptions and practices regarding ethical issues. Ethics is a major component of AI literacy (Long & Magerko, 2020; Wang et al., 2023) and was, in fact, one of the top concerns among our participants, according to the pre-survey conducted for this study; 34% of the participants (13 out of 38) responded that "academic dishonesty and plagiarism" was the most serious concern for them. There is no doubt that it will be a critical topic for future research on pre-service teachers' ethical concerns—how they may change (or not change) as they progress through professional development programs, and what kinds of needs they may have.

## **Conclusion**

While there is increasing attention on the role of AI in education, it is not entirely clear how to use it effectively (or whether to use it at all). Similarly, there is limited information on how to develop professional development programs that prepare pre-service language teachers to competently teach in an era of rapidly advancing AI technologies. To

address these needs, the present exploratory study focused on pre-service TESOL teachers in a professional development program and aimed to understand their perceptions of ChatGPT's affordances, the competencies necessary to use ChatGPT effectively, and how they incorporate these affordances into their pedagogical task designs to foster those competencies, specifically in the context of academic writing.

The study found that while pre-service teachers identified certain affordances and competencies, they struggled to shift from viewing the use of ChatGPT from a student's perspective to that of a teacher. They also faced challenges in using ChatGPT to support student learning (using it *for* learning), rather than simply using it alongside learning (using it *in* learning). This highlights the potential need to foster pedagogical strategies in professional development programs, particularly in the areas of basic language skills, prompting skills, and critical thinking skills. Given that pre-service teachers with relatively lower writing proficiency focused primarily on evaluative competencies while paying less attention to more foundational ones, such as basic language skills, targeted support to help these teachers recognize the value of foundational competencies may be especially important. More intervention studies conducted by teacher educators are necessary to better address teachers' needs in rapidly changing digital classrooms and societies.

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Yuko Goto Butler: Conceptualization, Methodology, Formal Analysis, Investigation, Resources, Data Curation, Writing – Original, Writing - Review & Editing, Supervision, Project Administration

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We did not use any AI tool in this manuscript.

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#### **World Medical Association (WMA) Declaration of Helsinki–Ethical Principles for Medical Research Involving Human Participants**

Not applicable.

### **Competing Interests**

No competing interests.

### **Data Availability**

Contact the authors.

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