English Language Teaching Educational Journal
Vol. 8, No. 3, December 2025, pp. 164-176

ISSN 2621-6485

Exploring AI-mediated linguistic and cognitive support for non-native English speakers in English-only higher education

Ching-Yi Tien [a, 1, *], Noor Azam Haji-Othman [b, 2]

[a] Shou University, No.1, Sec. 1, Syuecheng Rd., Dashu District, Kaohsiung City 84001, Taiwan
[b] Universiti Brunei Darussalam, Jalan Tungku Link, BE1410, Brunei Darussalam

[1] tien@isu.edu.tw *; [2] azam.othman@ubd.edu.bn

*corresponding author

ARTICLE INFO

Article history
Received 10 August 2025
Revised 25 November 2025
Accepted 9 December 2025
Available Online 15 December 2025

Keywords
Artificial intelligence
Higher education
Language learning
Cognitive ability
NNES student

ABSTRACT

The release of ChatGPT by OpenAI in 2022 marked a major milestone, beginning a new phase in how artificial intelligence (AI) is used in education and transforming the way students access and engage with academic resources. This study explores how non-native English-speaking students handle the language challenges of content-area courses in higher education when instruction is focused solely on professional subjects in an English-only setting, with limited explicit language support to improve English skills. Using a sample of undergraduate students (N = 63), this research examines differences in AI tool usage, perceptions, and outcomes based on gender, nationality, major, and year of study. Independent samples t-tests and one-way ANOVA were performed on variables that measure perceived language learning benefits, cognitive skill development, creative tool use, and the overall effectiveness of AI tools. Open-ended questions provided qualitative data for this study. The findings show that AI and Generative AI tools meet students' linguistic needs, address cognitive demands, support personalized learning, enhance understanding of subject material, and improve academic performance. Contrary to earlier research suggesting male students are more proficient with AI, this study finds that female students are more likely to view AI tools as beneficial for integrating thinking and higher-order cognitive skills. The study also discusses potential challenges related to AI use and notes its methodological limitations.

How to Cite: Tien, C. Y., & Haji-Othman, N. A. (2025). Exploring AI-mediated linguistic and cognitive support for non-native English speakers in English-only higher education. *English Language Teaching Educational Journal, 8*(3), 164-176. https://doi.org/10.12928/eltej.v8i3.14228

1. Introduction

Since John McCarthy coined the term *Artificial Intelligence* (AI) in 1956 (Zawacki-Richter et al., 2019), the field has evolved from abstract theory to a pervasive force shaping nearly all aspects of modern life. Within education, the COVID-19 pandemic accelerated the adoption of digital technologies, prompting a rapid shift toward online and blended learning models (Salido et al., 2025; Ng et al., 2023). This transformation laid the groundwork for the growing integration of AI-supported learning tools in higher education. The release of ChatGPT by OpenAI in 2022 represents a significant turning point in the use of AI in education, particularly in how learners interact with and access language learning resources (He, 2025; Moorhouse, 2024; Moorhouse & Wong, 2025; Moorhouse et al, 2025). Concurrently, educational institutions are increasingly incorporating Generative AI (GenAI) to enhance personalized learning. These systems allow instructional content to be tailored to learners'

individual needs, styles, and paces (Trošelj et al., 2024), with GenAI technologies offering new forms of interactivity and customization that traditional methods often lack (Torun & Ozer Sanal, 2025).

Within this context, AI and GenAI tools are being explored for their potential to support second-language learners in higher education (Alqarni et al, 2024; Chen, 2024; Choi, 2025; Chuang & Yan, 2025; Kwok et al., 2024; Liu & Fan, 2025; Nguyen & Nguyen, 2025). Prior studies have highlighted several benefits of AI integration, including increased learner autonomy (Moorhouse & Wong, 2025), enhanced vocabulary acquisition (Alharbi & Khalil, 2023), and improved academic writing (Chen et al., 2026; Thangthong et al., 2024; Ozfidan et al., 2024), gender differences in engagement with GenAI tools in academic contexts (Hillman, 2025; Tang, 2025). These tools allow students to design individualized practice tasks, receive instant feedback, and engage in simulated conversations, features particularly valuable for learners with limited access to consistent language practice opportunities.

Even before the rise of GenAI, tools like Grammarly have been widely adopted for academic writing support (van Wyk, 2025). Dizon and Gayed (2024) conducted a systematic review of Grammarly's use in L2 contexts. They argued that such tools are best employed alongside instructor feedback, allowing teachers to focus on higher-level concerns such as content and coherence, while the tool addresses surface-level errors. However, they caution that effective use of these tools requires training in their strengths and limitations to avoid blind dependence and to foster critical engagement.

Then, the emergence of ChatGPT has intensified scholarly interest in AI's pedagogical value (Alhur et al., 2025; Lin & Tsou, 2025; Tsou et al., 2024). Studies have shown positive correlations between its use and improved student performance, engagement, and perceptions of learning (Lu et al., 2024; Wang & Fan, 2025; Wei, 2023). Research also points to AI's potential to enhance vocabulary acquisition and content-specific learning. In their 2024 study, Nga and Ha explored the use of AI to improve vocabulary among university students, highlighting the importance of addressing data privacy and security concerns. They emphasized that educational institutions must safeguard student data and that educators should be cautious about students becoming overly dependent on AI tools, as this reliance could impede the development of autonomous learning abilities. Similarly, Nguyen (2023), in a study on sustainable fashion education, observed that students using NLP tools like ChatGPT reported improved vocabulary and content comprehension (Rahimi et al., 2025; Zhou et al., 2025). However, studies also stressed the need for clear instructional policies to prevent passive learning and to encourage active engagement (Al-Harahsheh et al., 2025; Tran, 2025). Nevertheless, AI engagement is not always reflective or strategic. Burkhard (2022) observed that while some learners adopted AI writing tools uncritically, raising concerns about unintentional plagiarism, still others hesitated due to skepticism or a lack of metacognitive strategies.

Beyond language development, AI is increasingly researched for its impact on students' cognitive growth (Ng, 2024; Wang et al., 2025). Holmes et al. (2023) argue that when integrated effectively, AI tools can enhance critical thinking by encouraging learners to analyze, evaluate, and generate content. However, findings remain mixed. Xu (2024) reported positive cognitive outcomes among university students using AI-assisted learning, while Gerlich (2025), employing a large-scale mixed-methods design, found that frequent reliance on AI tools may lead to cognitive offloading and reduce critical thinking, especially when not supported by pedagogical scaffolding.

Despite its growing presence, the adoption of AI in educational settings remains uneven. Zawacki-Richter et al. (2019), in a systematic review of 146 studies, found that research in this field is dominated by STEM disciplines, with only a small fraction led by scholars from education. This highlights the need for more pedagogically-grounded research on how AI affects language learning, particularly in subject-related courses and cognitive engagement. Additionally, concerns about AI's implications for human expertise continue to surface. For instance, Humanika and Radjaban (2024) found that while some translation students viewed AI as a useful tool to enhance efficiency, others feared that it could diminish job prospects by automating complex linguistic tasks. However, its limitations in processing idiomatic and culturally embedded language remain evident.

Despite increasing interest in AI in education, a significant research gap persists regarding how non-native English-speaking (NNES) students in content-based courses in EFL higher education settings use AI to support both linguistic and cognitive development. Few studies focus on learners in non-English-speaking contexts, such as Taiwan, where international and local students share multilingual academic environments but face similar linguistic challenges in English-medium

coursework. To fill this gap, the present study investigates how NNES students at an international college in Taiwan use AI tools to enhance language skills, academic achievement, and cognitive engagement in content courses with limited explicit language support. The findings aim to clarify AI's potential and limitations in EMI classrooms and contribute to more informed pedagogical decision-making. Unlike previous research centered on language-specific applications, this study explores how students use AI to bridge both linguistic and cognitive gaps in English-only content-course environments. The research questions guiding this study are as follows.

1. How do AI tools assist non-native English-speaking students (NNES) in managing linguistic demands in content-area courses where instructors do not address students' language development?
2. To what extent do AI applications support cognitive development among non-English-speaking students?
3. What are students' perceptions of the usefulness, challenges, and integration of AI tools in their academic routines?
4. Are gender, student status, academic major, and year-of-study significant factors influencing students' adoption of AI applications?

2. Method

2.1. Participants

Participants were recruited through convenience sampling from two courses at an international college in southern Taiwan. Class One consisted of 14 students (22.2%) from the Program in International Media and Entertainment Management enrolled in advertising courses, while Class Two included 36 students (57.1%) from the Department of Global Communications and Applied English taking an Introduction to Linguistics course. Additional students from other departments also enrolled. Both 18-week courses were delivered in English and focused on content instruction with minimal explicit language support. The demographic breakdown of the 63 participants was as follows: 18 (28.6%) were male, 44 (69.8%) were female, and 1 (1.6%) preferred not to specify their gender. Among the participants, 25 (39.7%) were international students, while 38 (60.3%) were local students. International students mainly came from Southeast and East Asian countries such as Indonesia, Thailand, Vietnam, and Japan. The students' year distribution was: Freshman (1.6%), Sophomore (30.2%), Junior (47.6%), and Senior (20.6%). All participants had studied English for more than ten years.

2.2. Data Collection Technique

Data for this research were collected at the end of the spring 2024 semester. The questionnaire items were adapted from prior studies on AI-assisted learning (e.g., Lu et al., 2024; Wang & Fan, 2025) and were reviewed by two experts in applied linguistics for content validity. A structured questionnaire contained 32 items, with four items in Part I aimed at understanding the demographic information of the participants; eight items in Part II seek to find out the use of AI tools in students' English language skills; six items in Part III aim to reveal AI applications that support students' cognitive skills; nine items in Part IV aim to investigate how students integrate AI tools into their study routines; Part V included five open-ended questions about students' preferred tools, perceived improvements, challenges, and suggestions for using AI in their academic work.

Participants rated their agreement on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree). To assess the survey's internal consistency, Cronbach's alpha was calculated. The scale demonstrated excellent internal consistency (Cronbach's $\alpha = .924$; 23 items), indicating that the items reliably measure the same construct. Additionally, the Cronbach's alpha based on standardized items was 0.930, showing that even when accounting for differences in item variance, the reliability remains very high. According to conventional thresholds, a Cronbach's alpha above 0.90 is considered excellent (George & Mallery, 2003). All items confirmed that the questionnaire was effective in measuring responses related to the use of AI applications among the participants in higher education.

2.3. Data analysis

Descriptive statistics were generated using SPSS version 27. Before conducting inferential tests, data were checked for normality and homogeneity of variance. A one-way ANOVA was used to examine differences across gender, major, and year of study, and independent samples t-tests compared international and local Taiwanese students. Open-ended responses were analyzed through thematic analysis to identify recurring themes in AI use. Ethical approval and informed consent were obtained prior to data collection.

3. Finding and Discussion

3.1 Findings

To assess how effective AI tools are in helping non-native English-speaking students handle linguistic challenges in content-area courses where instructors do not prioritize language development, descriptive statistics were utilized to analyze questionnaire data. The open-ended responses were reviewed to supplement the qualitative data and assist the researcher in gaining a more comprehensive understanding of how students used the AI tool during their academic programs. The following sections generally address the four research questions of this study.

RQ1: How do AI tools assist non-native English-speaking (NNES) students in managing linguistic demands in content-area courses where instructors do not address students' language development?

To answer the first research question, the data from Part II of the questionnaire were analyzed using SPSS 27 software. The results are arranged in descending order to highlight the most-to-least perceived benefits of AI tools.

Table 1. Students' Usage of AI Tools for Addressing Linguistic Challenges

Item	Mean	S.D.
1.2 AI tools have helped me with grammar and sentence structure.	4.19	1.030
1.4 AI tools have made me more confident in writing English.	3.97	1.015
1.1 AI tools have enhanced my vocabulary.	3.95	1.069
1.5 AI tools have helped me to understand English-only content courses better.	3.84	1.081
1.8 AI applications make my schoolwork more engaging and fun.	3.78	.941
1.7 AI applications give valuable feedback on my language skills.	3.73	.971
1.3 AI tools have improved my pronunciation and speaking skills.	3.51	1.230

Table 1 summarizes students' perceptions of how AI tools support their language needs. Students rated AI as most helpful for improving grammar and sentence structure (M = 4.19, SD = 1.03), followed by boosting writing confidence (M = 3.97, SD = 1.02) and expanding vocabulary (M = 3.95, SD = 1.07). They also agreed that AI tools improved their understanding of English-only content courses (M = 3.84, SD = 1.08). Pronunciation and speaking skills received the lowest scores (M = 3.51, SD = 1.23), indicating more limited perceived benefits. AI was seen as moderately effective for engagement (M = 3.78, SD = 0.94) and providing feedback (M = 3.73, SD = 0.97). Regarding the most useful tool, ChatGPT was chosen by 54% of students, followed by Grammarly (33.3%), Copilot (4.8%), Gemini (1.6%), and others (6.3%).

Responses from the open-ended section of the qualitative data include a question about "what specific AI tools or applications have you used to improve your English language skills?" ChatGPT was mentioned 20 times, followed by Grammarly (14), Quillbot (4), Google (3), VoiceTube (2), and others (2) by the participants. These results suggest that ChatGPT and Grammarly are the primary tools students prefer for improving or getting help with their language skills. When asked, can you describe any notable improvements you have noticed in your English skills or thinking abilities since using AI tools? Participants reported various improvements from using AI or GenAI applications, such as a better vocabulary, improved grammar and sentence structure, enhanced comprehension and speed, increased confidence, and stronger critical thinking. Below are the students' direct quotes.

S3: I learned more vocabulary that I do not usually use in daily life.

S7: AI tools have helped me enhance my vocabulary, grammar, and sentence structure.

S31: My sentence structure is better than before.

S46: Grammarly helps me to correct my grammar mistakes, and ChatGPT gives me lots of useful information.

S50: I can understand the content more easily than before.

S26: Find the answer quickly.

S39: More confident to type English, no need to worry about mistakes

S45: I learn to know what good, high-quality writing and information look like.

Both descriptive statistics and participant feedback show that AI and GenAI tools significantly enhance the English language skills of non-English speakers, especially when explicit English instruction is not the main focus of the content courses.

RQ2: To what extent do AI applications support cognitive development among non-English-speaking students?

To address RQ2, quantitative data from questionnaire Part III were analyzed. The descriptive statistical results are presented in Table 2. The results are ordered from highest-to-lowest to emphasize the perceived benefits of AI tools in cognitive skills as reported by students.

Table 2. The Utilization of AI Tools for Cognitive Skills

Item	Mean	S.D.
2.1 AI applications have improved my ability to analyze information.	3.95	.958
2.2 AI applications have helped me in developing better problem-solving strategies.	3.90	.928
2.4 AI applications have enhanced my ability to make connections between different pieces of information.	3.86	.965
2.3 AI applications have made me more critical of the information I encounter.	3.84	.884
2.5 AI applications have helped me improve my focus and concentration.	3.44	.980

Table 2 shows students' perceptions of how AI tools supported their cognitive skills. AI was rated most helpful for analyzing information (M = 3.95, SD = 0.96), followed by developing problem-solving strategies (M = 3.90, SD = 0.93) and connecting ideas (M = 3.86, SD = 0.97). Critical thinking also showed positive, though slightly lower, improvement (M = 3.84, SD = 0.88). The lowest rating was for sustaining focus and concentration (M = 3.44, SD = 0.98), indicating a more limited perceived effect. When asked which tool best supported problem-solving, students most often chose ChatGPT (60.3%), followed by Google (30.2%), Copilot (4.58%), Gemini (3.2%), and others (1.16%), reflecting a strong preference for general-purpose AI tools.

In response to the open-ended question about whether their cognitive abilities had improved after using AI tools, students reported both benefits and some concerns. Below are selected direct quotes from the participants.

S14: I can go through with my ideas from concept to execution. It provides me with a clear structure and step-by-step solutions to problems, which have improved my ability to think outside the box. Running my essays through ChatGPT allows me to catch any redundant information/phrases/etc., and the program gives me feedback that I can apply in real-time.

S50: I can understand the content more easily than before.

S57: I have become better at clarifying any data or material from my learning.

Several participants highlighted the cognitive benefits of using AI tools like ChatGPT in their academic work. They noted improvements in organizing ideas from concept to execution, enhanced problem-solving through structured and step-by-step guidance, and the ability to think more creatively. Additionally, AI tools were seen as helpful for real-time feedback, improving clarity, minimizing redundancy in writing, and making learning materials easier to understand.

Despite the positive effects of using AI and generative AI (GenAI), several students expressed concerns about becoming overly reliant on these tools. Their responses reflect worries about diminished independent thinking and writing skills. Selected quotes include:

S9: I cannot think by myself.

S42: I have become lazy to think and go directly to AI when I encounter questions.

S52: It is getting worse because I do not have to think about it by myself.

S63: Initial overreliance on AI tools to generate content… worsened my ability to express myself through writing.

Some students reported that excessive reliance on AI tools negatively impacted their cognitive engagement. They noted a decline in their motivation to think independently, problem-solve, and articulate their thoughts clearly in writing. These reflections highlight the importance of balancing AI use with active learning to avoid dependency and maintain essential critical thinking skills.

Q3: What are students' perceptions of the usefulness, challenges, and integration of AI tools in their academic routines?

To address the research question concerning students' perceptions of the usefulness, challenges, and integration of AI tools in their academic routines, Table 3 presents the items sorted by mean score, from highest-to-lowest.

Table 3. Usage of AI Tools in Academic Routines

Item	Mean	S. D.
3.5 I believe AI tools are beneficial for language learning.	4.05	.888
3.8 I have seen positive results in my learning due to AI tools.	3.90	.979
3.6 AI tools have helped me achieve my learning goals.	3.90	.979
3.2 AI tools like Canva are easy to navigate and use.	3.84	1.208
3.1 I always use the AI tool Canva to create presentation content.	3.78	1.301
3.7 AI tools have helped me improve my grade.	3.73	.987
3.9 I have no negative concerns about using AI tools for my studies.	3.33	1.178
3.4 AI tools like Midjourney are easy to navigate and use.	2.98	1.338
3.3 I always use the AI tool Midjourney to create visual content.	2.70	1.466
3.5 I believe AI tools are beneficial for language learning.	4.05	.888

The data in Table 3 shows a largely positive attitude toward AI tools in educational settings. The highest agreement is for the statement "I believe AI tools are beneficial for language learning" (M = 4.05, SD = 0.89), indicating a strong consensus on AI's value in improving language skills. Positive impacts on learning outcomes are also reflected in responses to "I have seen positive results in my learning due to AI tools" and "AI tools have helped me achieve my learning goals" (both M = 3.90, SD = 0.98), suggesting that AI is considered effective for advancing education. AI's role in improving academic performance is moderately supported ("AI tools have helped me to improve my grade," M = 3.73, SD = 0.99), confirming their perceived usefulness beyond simple tasks. Regarding concerns, the average score for "I have no negative concerns about using AI tools for my studies" is 3.33 (SD = 1.18), reflecting a generally neutral to positive view, although some students still hold reservations.

The participants recruited for this study were enrolled in university-level Linguistics and Advertising courses. The researcher also aimed to explore whether students were using other generative AI tools, such as Canva and MidJourney. Therefore, additional questions regarding the application of these tools were included in the questionnaire. The results below report students' ease of use and tool preferences. When examining usability, tools such as Canva received moderately favorable ratings for ease of navigation and use (M = 3.84, SD = 1.21). The regularity of Canva's use for creating presentation content is also relatively high (M = 3.78, SD = 1.30), indicating its popularity and user-friendliness among students. In contrast, lower means are observed for Midjourney in both ease of use (M = 2.98, SD = 1.34) and frequency of use for creating visual content (M = 2.70, SD = 1.47). These results highlight potential barriers for participants, such as learning curves or tool accessibility, associated with more specialized AI tools. Overall, tools focused on language and presentation (e.g., Canvas) are seen as more accessible and beneficial compared to generative visual AI (e.g., Midjourney), which may necessitate further training or support. The results also suggest that

while AI tools are embraced for both content creation and skills development, their adoption is differentiated by type and complexity.

To better understand students' perceptions of the usefulness, challenges, and integration of AI tools, the survey included several open-ended questions. The qualitative responses showed that ChatGPT was by far the most frequently used tool (30 mentions), followed by Canva (6), Grammarly (4), Quillbot (3), and Gemini (2). This pattern highlights a strong reliance on a single, general-purpose generative AI tool for various academic tasks, while other applications were used more selectively for functions such as editing, paraphrasing, and visual content creation.

Students also reported several challenges related to AI use. The most common concern was overreliance, with some participants noting that frequent dependence on AI made them "lazy to think" and weakened their ability to express ideas independently. Others expressed concerns about accuracy, pointing out that AI sometimes produces outdated, incorrect, or awkward translations, highlighting the need for critical evaluation and fact-checking. Language barriers were also mentioned, as certain tools struggled to interpret user intent or generate context-appropriate phrasing. Additionally, though less frequently, concerns included cost, limited access to full features, internet dependency, and regional restrictions blocking access to specific platforms, all of which could hinder students' ability to explore a broader range of AI tools.

Q4: Are gender, student status, academic major, and year-of-study significant factors influencing students' adoption of AI applications?

To answer the final research question, descriptive statistics, analysis of variance (ANOVA), and independent samples t-tests were used. The results are shown in the following sections.

1) Gender

An ANOVA was performed to explore gender differences in perceptions of AI tools among male, female, and those who select "prefer not to say." Although most items showed no statistically significant differences, suggesting generally similar perceptions across groups, three items revealed notable variation. For Item 1.6 (preferred AI tool for language learning), females more often chose higher-coded tools than males, $F(2, 60) = 4.23$, $p = .019$. Significant differences also appeared for Item 2.1 (analytical ability), $F(2, 60) = 3.58$, $p = .034$, and Item 2.4 (integrative thinking), $F(2, 60) = 3.71$, $p = .030$, with female participants perceiving greater cognitive benefits. Overall, while attitudes toward AI were similar across genders, differences were seen in tool preferences and higher-level thinking skills, especially among female students.

2) International vs. Local Students

Independent samples t-tests were performed to compare perceptions of AI tools between international and local students. No statistically significant differences were found across all items. For example, regarding whether AI tools improved vocabulary (Item 1.1), the difference was not significant, $t(61) = -0.433$, $p = .667$. Similarly, there were no significant differences for grammar support, pronunciation, writing confidence, or problem-solving skills (all $p > .05$). These findings suggest that both international and local students generally hold similar views on how AI tools influence their learning.

3) Academic Major

An ANOVA was conducted to determine whether students' academic majors (i.e., IMEM, GCAE, or other) affected their opinions of AI tools in language learning and cognitive development. No significant differences were found for any item (all $p > .05$). For example, the difference in perceptions of grammar and sentence structure support was close but not statistically significant, $F(2, 60) = 2.73$, $p = .074$. This indicates that students from different academic backgrounds generally view the impact of AI tools similarly.

4) Year-of-Study

ANOVA results revealed significant differences across academic years. Academic engagement (Item 1.8) and perceived development of critical thinking (Item 2.3) varied notably, $F(3, 59) = 4.05$, $p = .011$, and $F(3, 59) = 2.91$, $p = .042$, respectively. Problem-solving applications (Item 2.6) approached significance, $F(3, 59) = 2.70$, $p = .054$, indicating a possible trend in tool preference across levels. These results suggest that academic progression influences certain perceptions of AI, with the most notable differences observed in engagement.

3.2. Discussion

This study aimed to examine how non-native English-speaking students handle the linguistic challenges of content-area courses in higher education when instruction is solely focused on professional subjects in an English-only setting, with limited explicit language support to improve English proficiency. Four research questions were addressed and discussed. While some findings align with existing literature, several new insights have also emerged.

Both quantitative and qualitative findings indicate that AI and GenAI applications play a substantial role in meeting students' linguistic needs, thereby enhancing their academic performance in content-area courses. Students reported that these tools were particularly effective in supporting grammar improvement, vocabulary expansion, writing accuracy, and comprehension of complex subject matter. This aligns with prior research suggesting that AI-assisted learning environments can provide immediate feedback, scaffold language learning, and reduce cognitive load, allowing learners to focus more effectively on content understanding (e.g., Ng et al., 2023; Moorhouse & Wong, 2025).

In the present study, participants highlighted the value of AI tools in bridging the gap between their existing English proficiency and the linguistic demands of English-only instruction. For example, AI-powered grammar checkers and writing assistants were frequently cited as instrumental in producing academically appropriate texts. Meanwhile, AI chatbots and translation features helped clarify discipline-specific terminology and concepts. The findings also revealed that students perceived these tools as confidence-building resources, enabling them to participate more actively in academic discussions and written assignments. Moreover, the results indicate that participants have become adept at using AI and GenAI tools to engage in personalized, or so-called adaptive, learning, an approach supported by numerous studies (Campbell & Cox, 2024; Shalevska, 2024; Torun & Sanal, 2025; Wei, 2023). The notable improvement in students' knowledge after using tools such as ChatGPT and Grammarly highlights their potential to foster independent learning. Further, it fosters autonomous learning, a vital skill in higher education. However, the results also suggest that while AI tools are embraced for content creation and skills development, their adoption is differentiated by type and complexity.

The study also revealed that students perceive AI tools as valuable for boosting cognitive skills. Quantitative data showed that the top-rated benefit was improved analytical skills, followed closely by better problem-solving strategies and the ability to combine information from different sources. Improvements in critical thinking were also recognized, though to a lesser extent, while focus and concentration received the lowest ratings, indicating a more variable impact in this area. These findings align with Xu's (2024) study, which showed that AI can significantly enhance cognitive skills like critical thinking and problem-solving. Qualitative feedback reinforced these findings. Students explained how AI tools, especially ChatGPT, helped them organize ideas from start to finish, approach problems systematically, think more creatively, and improve the clarity of their writing through real-time feedback. Many also noted that AI made learning materials more accessible and easier to understand.

Overall, these linguistic and cognitive outcomes suggest that AI tools serve as a dual scaffold in EMI settings. As students develop more precise vocabulary, grammar, and comprehension with AI support, they can shift cognitive resources toward higher-level tasks such as analysis, synthesis, and problem-solving. This interaction indicates that linguistic improvements may enable more advanced cognitive engagement in English-only courses. At the same time, the results emphasize the importance of preventing overreliance. Incorporating AI-literacy activities, such as evaluating AI-generated outputs or keeping brief reflective logs, can help students use AI more strategically while preserving opportunities for independent thinking. Several participants reported decreased motivation to think independently, reduced autonomy in problem-solving, and a weaker ability to express ideas without AI assistance. This finding echoes Gerlich's (2024) study, which showed that greater use or dependence on AI tools is associated with reduced or declining critical thinking skills. These concerns align with ongoing debates about balancing AI support with the development of independent cognitive and language skills.

A key contribution of this study is examining how background factors (gender, nationality, academic major, and year of study) influence students' adoption and perceptions of AI tools. Regarding gender, although overall attitudes toward AI were similar, female students were more likely to view AI as helpful for integrative thinking and higher-level cognitive skills. This finding contrasts

with studies like Tang et al. (2025) and Hillman (2025), which reported stronger AI engagement among male students. These differences may stem from contextual factors such as cultural background, academic environment, or disciplinary expectations.

There were no significant differences between international and local students or across academic majors, indicating that these groups generally shared similar views on AI's linguistic and cognitive benefits. However, the year of study showed notable variation; upper-year students reported higher engagement and greater cognitive improvements from using AI. This pattern suggests that academic maturity and familiarity with AI may influence how students integrate these tools into their learning. These results highlight the need to customize AI-supported learning activities to match students' developmental levels and academic needs.

3.3. Limitations

This study has several limitations. First, convenience sampling from two classes at a private university in southern Taiwan restricts how broadly the findings can be applied. Second, although quantitative data were complemented with open-ended responses, the absence of interviews prevented a deeper exploration of student perspectives. Future research should incorporate focus groups and additional data sources, such as behavioral traces or performance measures, and explore different disciplines to see if gender and year-of-study effects remain. The findings also highlight the importance of pedagogical strategies that use AI as a scaffold to support independent learning and critical thinking. Training students to use AI strategically rather than routinely will help maximize its benefits and reduce overdependence.

4. Conclusion

This study examined how non-native English-speaking students manage the linguistic demands of English-only content courses with minimal language support. The results show that AI tools, especially ChatGPT and Grammarly, significantly assisted students with their language skills and thinking processes, enhancing grammar, vocabulary, and analytical abilities, though concerns about reliance persisted. Perceptions were generally positive across various groups, with some differences based on academic year. More research in broader settings is needed to understand how NNES students use AI and the challenges they face. The study highlights the need for clear institutional guidelines to encourage responsible and strategic use of AI in higher education. As AI becomes more integrated into learning environments, universities should promote practices that improve teaching, learning efficiency, and student engagement. Overall, this research provides empirical evidence from a non-native English-speaking context, demonstrating AI's potential to support language and cognitive development while emphasizing the importance of guiding learners to use AI thoughtfully and independently.

Acknowledgment

The researcher gratefully acknowledges the participation and valuable contributions of all the students who took part in this study. Their time, insights, and willingness to share their experiences made this research possible.

Declarations

Author contribution	:	The research was collaboratively undertaken by both authors, encompassing topic selection, proposal development, methodological application, data analysis, and the preparation of the discussion section.
Funding statement	:	No funding is available for this research.
Conflict of interest	:	I declare that there are no competing interests.

Ethics Declaration	:	As the authors, we confirm that this work has been written based on ethical research principles in compliance with our university's regulations and that the necessary permission was obtained from the relevant institution during data collection. We fully support ELTEJ's commitment to upholding high standards of professional conduct and practicing honesty in all academic and professional activities.
Additional information	:	No additional information is available for this paper.

REFERENCES

Al-Harahsheh, A., Almahasees, Z., & Al Rousan, R. (2025). The use of ChatGPT in academic writing by university students in Jordan. *International Journal of Information and Education Technology, 15*(7), 1468–1476. https://doi.org/10.18178/ijiet.2025.15.7.2348

Alharbi, K., & Khalil, L. (2023). Artificial Intelligence (AI) in ESL vocabulary learning: An exploratory study on students' and teachers' perspectives. *Migration Letters, 20*(S12), 1030–1045. https://www.researchgate.net/publication/380465714

Alhur, A. A., Khlaif, Z.N., Hamamra, B., Hussein, E. (2025) Paradox of AI in Higher Education: Qualitative Inquiry Into AI Dependency Among Educators in Palestine. *JMIR Med Educ*, 11:e74947. hppts://doi: 10.2196/74947

Alqarni, O. M., Curle, S., Mahdi, H. S., & Ali, J. K. M. (2024). Medical Students' Perceptions of ChatGPT Integration in English Medium Instruction: A Study from Saudi Arabia. *Forum for Linguistic Studies*, 6(5), 749–763. https://doi.org/10.30564/fls.v6i5.6975

Bälter, O., Kann, V., Mutimukwe, C., & Malmström, H. (2024). English-medium instruction and impact on academic performance: A randomized control study. *Applied Linguistics Review*, 15(6), 23732396. https://doi.org/10.1515/applirev-2022-0093

Burkhard, M. (2022). Student perceptions of AI-powered writing tools: Towards individualized teaching strategies. *In Proceedings of the 19th International Conference on Cognition and Exploratory Learning in Digital Age (CELDA 2022) (pp. 73–81). IADIS Press*. https://eric.ed.gov/?id=ED626893

Campbell, L. O., & Cox, T. D. (2024). Utilizing Generative AI in Higher Education Teaching and Learning. Journal of the Scholarship of Teaching and Learning, 24(4), 162-173. https://doi.org/10.14434/josotl.v24i4.36575

Chen, X., Zhou, X., & Goh, Y. S. (2026). How Chinese as a foreign language learners use generative AI for oral script-writing: A qualitative perspective on cognitive scaffolding in project-based learning. *Acta Psychologica*, 262, 106071. https://doi.org/10.1016/j.actpsy.2025.106071

Chen, Y. (2024). Exploring the impact of ChatGPT on Chinese students' foreign language anxiety in EMI higher education. *Journal of Education, Humanities and Social Sciences*, 39, 347–360. https://doi.org/10.54097/psy0yy79

Choi, W. (2025). The role of changes in pronunciation ability and anxiety through Gen-AI on EFL learners' self-directed speaking motivation and social interaction confidence: A CHAT perspective. *System*, 133, 103788. https://doi.org/10.1016/j.system.2025.103788

Chuang, P.-L., & Yan, X. (2025). Language assessment in the era of generative artificial intelligence: Opportunities, challenges, and future directions. *System*, 134, 103846. https://doi.org/10.1016/j.system.2025.103846

Ding, A.-C. E., Shi, L., Yang, H., & Choi, I. (2024). Enhancing teacher AI literacy and integration through various case studies in teacher professional development. *Computers and Education Open, 6*, 100178. https://doi.org/10.1016/j.caeo.2024.100178

Dizon, G., & Gayed, J. M. (2024). A systematic review of Grammarly in L2 English writing contexts. *Cogent Education*, 11(1), Article 2397882. https://doi.org/10.1080/2331186X.2024.2397882

Gayed, J. M. (2025). Educators' perspective on artificial intelligence: equity, preparedness, and development. *Cogent Education*, 12(1), Article 2447169. https://doi.org/10.1080/2331186X.2024.2447169

George, D., & Mallery, P. (2003). *SPSS for Windows Step by Step: A Simple Guide and Reference* (4th ed.). Boston: Allyn & Bacon.

Gerlich, M. (2025). AI Tools in Society: Impacts on Cognitive Offloading and the Future of Critical Thinking. *Societies*, 15(1), 6. https://doi.org/10.3390/soc15010006

Hashem Mahmoud Muslim al-Zyoud (2020). The Role of Artificial Intelligence in Teacher Professional Development. *Universal Journal of Educational Research*, 8(11B), 6263–6272. http://doi:10.13189/ujer.2020.082265

He, G. (2025). Predicting learner autonomy through AI-supported self-regulated learning: A social cognitive theory approach. *Learning and Motivation*, 92, 102195. https://doi.org/10.1016/j.lmot.2025.102195

Hillman, N. (2025, February 26). *Student generative AI survey 2025*. Higher Education Policy Institute (HEPI). https://www.hepi.ac.uk/2025/02/26/student-generative-ai-survey-2025/

Holmes, W., Bialik, M., & Fadel, C. (2023). Artificial Intelligence in Education. *Globethics Publications*, 621–653. https://doi.org/10.58863/20.500.12424/4276068

Huang, Y. K., Chang, M., & Liu, S. (2025). Taiwanese high school students' perspectives on artificial intelligence and its applications. *Computers in Human Behavior Reports*, 17, 100550. https://doi.org/10.1016/j.chbr.2024.100550

Humanika, E. S. & Radjaban, R, Y. (2024). Shaping the future of translation careers: Student interest and the need for curriculum reform in the AI Era. *English Language Teaching Educational Journal*, 7(3), 139-149. https://doi.org/10.12928/eltej.v7i3.12016

Kwok, A. P. K., Wong, Y. H., Wong, K. C., & Chan, C. H. (2024). AI Meeting Assistants in English-medium university lectures in Hong Kong, China: A double-edged sword for student perception. *International Journal of Information and Education Technology*, 14(9), 1271–1276. https://doi.org/10.18178/ijiet.2024.14.9.2156

Lin, L., & Tsou, W. (2025). Technology-mediated online EMI professional development: Developing faculty self-efficacy and teaching practice through the community of inquiry framework. *System*, 133, 103727. https://doi.org/10.1016/j.system.2025.103727

Liu, H., & Fan, J. (2025). AI-Mediated Communication in EFL Classrooms: The Role of Technical and Pedagogical Stimuli and the Mediating Effects of AI Literacy and Enjoyment. *European Journal of Education*, 60(1), e12813. https://doi.org/10.1111/ejed.12813

Liu, S., Guo, D., Sun, J., Yu, J., & Zhou, D. (2020). MapOnLearn: The use of maps in online learning systems for education sustainability. *Sustainability*,12(17), https://doi.org/10.33902/su12177018

Lu, J, Zheng R, Gong Z, & Xu H. (2024). Supporting teachers' professional development with generative AI: the effects on higher-order thinking and self-efficacy. *IEEE Trans Learn Technol* 17:1279 1289. https://doi.org/10.1109/tlt. 2024.3369690

Moorhouse, B. L. (2024). Generative artificial intelligence and ELT. *ELT Journal*, 78(4), 378–392. https://doi.org/10.1093/elt/ccae032

Moorhouse, B. L., & Wong, K. M. (2025). *Generative Artificial Intelligence and Language Teaching*. Cambridge University Press. https://doi.org/10.1017/9781009618823

Moorhouse, B. L., Wan, Y., Wu, C., Wu, M., & Ho, T. Y. (2025). Generative AI tools and empowerment in L2 academic writing. *System*, 133, 103779. https://doi.org/10.1016/j.system.2025.103779

Ng, D. T. K., Leung, J. K. L., Su, J., Ng, R. C. W., &, Chu S. K. W. (2023). Teachers' AI digital competencies and twenty-first century skills in the postpandemic world. *Educational Technology Research & Development*, 71(1), 137–161. https://doi.org/10.1007/s11423-023-10203-6

Ng, D. T. K., Xinyu, C., Lok Leung, J. K., & Wah Chu, S. K. (2024). Fostering students' AI literacy development through educational games: AI knowledge, affective and cognitive engagement. *Journal of Computer Assisted Learning*, 40(5), 2049-2064. https://doi.org/10.1111/jcal.13009

Nga, L. T. T., & Ha, D. H. (2024). Using artificial intelligence to enhance students' vocabulary in higher education. *Journal of Contents Computing*, 6(1), 1–11. https://doi.org/10.9728/jcc.2024.06.6.1.1

Nguyen, H. T., & Nguyen, P. T. (2025). ChatGPT in Language Education: Applications and Implications for Teaching and Learning. *Educational Process: International Journal*, 18, e2025464. https://doi.org/10.22521/edupij.2025.18.464

Nguyen, T. H. M. (2025). Factors affecting the use of ChatGPT in academic writing perceived by English-majored students. *VNU Journal of Foreign Studies, 41*(3), 110–125. https://doi.org/10.63023/2525-2445/jfs.ulis.5519

Nguyen, T. T. P. (2023). Factors affecting the use of ChatGPT in academic writing perceived by English-majored students. *VNU Journal of Foreign Studies*, 39(4), 47–59. https://doi.org/10.25073/2525-2445/vnufs.4763

Ozfidan, B., El-Dakhs, D. A. S., & Alsalim, L. A. (2024). The use of AI tools in English academic writing by Saudi undergraduates. *Contemporary Educational Technology*, 16(4), ep527. https://doi.org/10.30935/cedtech/15013

Rahimi, A. R., Sheyhkholeslami, M., & Mahmoudi Pour, A. (2025). Uncovering personalized L2 motivation and self-regulation in ChatGPT-assisted language learning: A hybrid PLS-SEM-ANN approach. *Computers in Human Behavior Reports*, 17, 100539. https://doi.org/10.1016/j.chbr.2024.100539

Salido, A., Syarif, I., Sitepu, M. S., Suparjan, Wana, P. R., Taufika, R., & Melisa, R. (2025). Artificial intelligence and critical thinking in higher education: A bibliometric and systematic review. *Social Sciences & Humanities Open*, 12, 101924. https://doi.org/10.1016/j.ssaho.2025.101924

Shalevska, E. (2024). The future of political discourse: AI and media literacy education. Journal of Legal and Political Education, (1), 50-61. https://doi.org/10.47305/JLPE2411050sh

Tang, B., Nie, S., Liang, Y., Xu, C., & Li, J. (2025). Gender differences in engagement with generative AI tools in academic contexts. *PNAS Nexus*, 4(2), pgae591. https://doi.org/10.1093/pnasnexus/pgae591

Tarisayi, K., & Manhibi, R. (2025). Revolutionizing Education in Zimbabwe: Stakeholder Perspectives on Strategic AI Integration. *Journal of Learning and Teaching in Digital Age*, 10(1), 87-93. https://doi.org/10.53850/joltida.1493508

Thangthong, P., Phiromsombut, J., & Imsa-ard, P. (2024). Navigating AI writing assistance tools: Unveiling the insights of Thai EFL learners. *THAITESOL Journal*, 37(1), 111–131.

Torun, F. & Ozer Sanal, S. (2025). The perspectives of academicians and students regarding the use of generative artificial intelligence in higher education. *International Journal of Technology in Education (IJTE)*, 8(1), 65-87. https://doi.org/10.46328/ijte.883

Tran, T. N. M. (2025). Factors affecting the use of ChatGPT in academic writing perceived by English-majored students. *VNU Journal of Foreign Studies, 41*(3), 110–125. https://doi.org/10.63023/2525-2445/jfs.ulis.5519

Trošelj, D. B., Maričić, S., & Ćurić, A. (2024). Growing Interest in AI in Education: Systematic Literature Review. In M. Shelley & O. T. Ozturk (Eds.), *Proceedings of ICRES 2024--International Conference on Research in Education and Science* (pp. 2410-2427), Antalya, Turkiye. ISTES.

Tsou, W., Lin, A. M. Y., & Chen, F. (2024). Co-journeying with ChatGPT in tertiary education: identity transformation of EMI teachers in Taiwan. *Language, Culture and Curriculum*, 37(4), 529–543. https://doi.org/10.1080/07908318.2024.2362326

van Wyk, M. M. (2025). Student Teachers' Leveraging GenAI Tools for Academic Writing, Design, and Prompting in an ODeL Course. *Open Praxis*, 17(1), pp. 95–107. https://doi.org/10.55982/openpraxis.17.1.711

Wang, J., & Fan, W. (2025). The effect of ChatGPT on students' learning performance, learning perception, and higher-order thinking: Insights from a meta-analysis. *Humanities and Social Sciences Communications*, *12*(1), 1-21. https://doi.org/10.1057/s41599-025-04787-y

Wang, X., Gao, Y., Wang, Q., & Zhang, P. (2025). Fostering Engagement in AI-Mediate Chinese EFL Classrooms: The Role of Classroom Climate, AI Literacy, and Resilience. *European Journal of Education*, 60(1), e12874. https://doi.org/10.1111/ejed.12874

Wei, L. (2023). Artificial intelligence in language instruction: Impact on English learning achievement, L2 motivation, and self-regulated learning. *Front. Psychol*. 14:1261955. http://doi: 10.3389/fpsyg.2023.1261955

Xu, Q. (2024). Action research plan: a methodology to examine the impact of artificial intelligence (AI) on the cognitive abilities of university students. *Discov Educ 3*, 224. https://doi.org/10.1007/s44217-024-00330-4

Zawacki-Richter, O., Marín, V. I., Bond, M. & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education – where are the educators? *International Journal of Educational Technology in Higher Education*, 16(1), 1–27. https://doi.org/10.1186/s41239-019-0171-0

Zhou, R., He, X., Fan, Q., Li, Y., Li, Y., Xiao, X., & Fang, J. (2025). Exploring ChatGPT-Facilitated Scaffolding in Undergraduates' Mathematical Problem Solving. *Journal of Computer Assisted Learning*, 41(4), e70077. https://doi.org/10.1111/jcal.70077