THE EFFECTS OF AI TOOL INTEGRATION ON ENGLISH FOR SPECIFIC PURPOSES LEARNING IN LOGISTICS EDUCATION

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Abstract: *Learning English for Specific Purposes (ESP) is more than just learning a language. It includes basic skills like writing, reading, listening, and speaking, together with special terms and knowledge from specific areas. In the field of business and economics, ESP courses often need students to do tasks like giving presentations and writing essays. These tasks require a lot of self-study outside the class, and students often struggle because they don't have enough helpful tools. This study looks at 56 logistics students who were studying ESP at a university. AI tools were used as a part of their learning process to help them. The research used both qualitative and quantitative methods to see how using AI tools affected students' learning and their opinions about these tools. The results indicate a substantial improvement in students' scores, providing empirical support for the effectiveness of AI tools in enhancing ESP learning. Also, students had a positive attitude toward these tools, showing they liked and used them as helpful resources for learning by themselves. This study suggests that AI tools should not be seen as cheating but as helpers for students to learn on their own. With AI technology, students can learn ESP independently, improving their language skills and becoming better at self-directed learning.*

Keywords: *English for specific purposes, AI tools, self-directed learning*

INTRODUCTION

Mastering English for Specific Purposes (ESP) has become increasingly essential for logistics students, particularly at universities specializing in economics and business studies. Throughout their academic journey,

students rely on the four key language skills - listening, reading, writing, and speaking - not only for general academic success but also for meeting the specific demands of their field. For logistics students, understanding domain-specific terminology and concepts is especially crucial. This knowledge enables them to comprehend specialized course materials and actively participate in academic tasks such as presentations and essay writing, which are integral components of their coursework (Wang & Jiang, 2014).

Despite its importance, many students face challenges in adopting effective methods for learning ESP. A significant issue lies in the overemphasis on mastering fundamental skills without integrating them into practical, industry-relevant contexts. Students often rely on rote memorization of terminology and concepts, neglecting the application of these skills in real-world scenarios. Furthermore, many fail to dedicate adequate time to independent self-study, a critical factor for successfully mastering both linguistic competencies and specialized vocabulary (Widodo, 2016). These difficulties are particularly pronounced in a complex and technical field such as logistics, where a deeper understanding of professional language and practice is required.

Given that a substantial portion of university education emphasizes self-directed learning, innovative approaches are necessary to address these challenges. The integration of AI-powered tools into ESP learning offers a promising solution. AI tools such as ChatGPT, Grammarly, and Duolingo provide tailored feedback, facilitate interactive learning experiences, and help students practice language skills in meaningful ways. Research has shown the general benefits of AI in language education, including improved engagement and personalized instruction, but there is limited exploration of its application in ESP courses, particularly for logistics students (Bilad et al., 2023; Yunus & Damayanti, 2024).

To address this gap, the present study investigates the capacity of AI-powered applications to support self-directed learning and the acquisition of discipline-specific skills in an ESP context for logistics

students. It pursues two interrelated objectives: first, to evaluate how the integration of AI tools (Grammarly) influences learners' academic performance in an ESP course; and second, to explore students' attitudes and experiences when employing these tools during their independent study. These objectives are examined through a mixed-methods case study of 56 logistics undergraduates at the University of Economics Ho Chi Minh City, each of whom used AI resources as a structured element of their ESP curriculum.

By combining quantitative measures of pre- and post-test performance with qualitative insights from semi-structured interviews, this research demonstrates how AI integration can heighten engagement, deepen mastery of logistics-specific terminology, and foster more effective autonomous learning strategies. The findings offer practical guidance for higher-education practitioners, illustrating how AI-enhanced ESP instruction can create more adaptive, student-centered learning environments and better prepare graduates for the communicative demands of the global logistics industry.

LITERATURE REVIEW

English for Specific Purposes for Logistics

The concept of English for Specific Purposes for Logistics

English for Specific Purposes (ESP) is a specialized area of English language teaching tailored to address the professional and academic needs of learners in distinct fields. Within the English for Specific Purposes (ESP) framework (Wang & Jiang, 2014), in which Logistics English is treated as a distinct subset, combining core language skills (listening, speaking, reading, writing) with the technical vocabulary and communicative practices essential to logistics professionals. The increasing globalization of trade and the pivotal role of logistics in facilitating goods movement have elevated the importance of Logistics English as a medium for international communication (Suraprajit et al., 2024; Wang & Jiang, 2014).

Logistics English equips practitioners with the linguistic tools needed to understand industry practices, engage effectively in negotiations, and manage technical documentation. Its emphasis on specialized vocabulary and formalized communication styles distinguishes it from general English. For instance, logistics professionals must master documents like bills of lading, letters of credit, and commercial invoices, which use standardized language structures to ensure clarity and consistency (Wang & Jiang, 2014). This focus on lexical, syntactic, and textual features underscores the indispensability of Logistics English in professional settings, making it a cornerstone of ESP education for logistics students.

Learning English for Specific Purposes for Logistics

Learning ESP for logistics is critical for equipping students and professionals with the skills to navigate the linguistic complexities of the logistics industry. Effective command of listening, reading, writing, and speaking in Logistics English is pivotal not only for academic success but also for career development. Students are often required to engage with materials that focus on key industry areas such as supply chains, transportation, and inventory management. Furthermore, interpreting technical documents, analyzing logistics-related data, and communicating effectively in professional contexts are essential skills for logistics students (Wang & Jiang, 2014; Widodo, 2016).

However, a significant challenge in ESP for logistics lies in bridging the gap between general English skills and the specialized demands of the logistics domain. Students must learn to navigate tasks such as reading industry-specific articles, interpreting technical graphs, and preparing detailed logistics reports. These activities are designed not only to enhance linguistic proficiency but also to build confidence in applying English skills within professional settings (Widodo, 2016). An effective ESP curriculum integrates vocational content with language learning, enabling students to simultaneously acquire technical expertise and linguistic capabilities (Suraprajit et al., 2024).

Assessment of English for Specific Purposes for Logistics

The assessment of ESP for logistics is focused on evaluating students' ability to apply their language skills in professional scenarios. Commonly used assessment tasks include writing business correspondence, preparing logistics reports, and delivering presentations on logistics-related topics. These assessments aim to measure not only linguistic accuracy but also the ability to effectively convey domain-specific information (Suraprajit et al., 2024; Wang & Jiang, 2014).

A practical approach is often adopted in ESP assessments, incorporating real-world scenarios such as designing shipping plans or analyzing supply chain challenges. This method ensures that students are well-prepared to meet the communication demands of their professional roles. For example, creating a shipping plan requires students to integrate technical language with strategic thinking, fostering both linguistic and operational competencies (Widodo, 2016).

The integration of AI tools into ESP assessments has added a new dimension to evaluating and enhancing students' skills. AI-powered platforms like Grammarly and ChatGPT provide instant feedback on writing tasks, enabling students to identify and address areas for improvement. This immediate feedback mechanism aligns closely with industry requirements, helping students refine their language skills and adapt to the expectations of the global logistics market (Suraprajit et al., 2024).

Self-Directed Learning in Language Learning

The concept of Self-Directed Learning

Self-directed learning (SDL) is a learner-centered approach in which individuals take initiative in identifying their learning needs, setting goals, selecting strategies, and evaluating outcomes. SDL empowers learners to take control of their educational journey, making it especially significant in adult education. It is rooted in the principle of autonomy, where learners engage actively and independently in

acquiring knowledge and skills (Kimsesiz, 2023; Robles Arboleda et al., 2024). This approach contrasts traditional teaching methods by promoting proactive and autonomous learning behaviors, emphasizing the development of metacognitive, motivational, and behavioral competencies (Yunus & Damayanti, 2024).

The Importance of Self-Directed Learning in Language Learning

In language learning, SDL is crucial for developing autonomy and adapting to diverse linguistic and cultural contexts. It allows learners to tailor their strategies to meet personal, academic, or professional objectives, fostering motivation and long-term commitment (Robles Arboleda et al., 2024; Yunus & Damayanti, 2024). SDL facilitates effective use of resources, such as digital platforms, social media, and authentic linguistic materials, which are critical in mastering complex language skills like listening and speaking (Kimsesiz, 2023; Yunus & Damayanti, 2024). The flexibility of SDL also accommodates individual learning paces and schedules, making it particularly valuable for adult learners balancing multiple responsibilities (Robles Arboleda et al., 2024).

Moreover, SDL enhances critical competencies, including self-monitoring, goal setting, and problem-solving, which are essential for navigating the challenges of language acquisition. Research highlights its role in fostering confidence, improving linguistic proficiency, and promoting a deeper understanding of the language (Kimsesiz, 2023; Yunus & Damayanti, 2024).

The Challenges of Self-Directed Learning in English for Specific Purposes for Logistics

While SDL offers many benefits, its application in English for Specific Purposes (ESP) for logistics presents unique challenges. Students often face difficulties accessing authentic and relevant materials tailored to the logistics industry, which limits their exposure to specialized terminology and contextual language usage. This lack of access can hinder their ability to effectively apply English in professional scenarios (Suraprajit et al., 2024; Wang & Jiang, 2014).

Additionally, the absence of structured guidance in SDL may lead to inefficient use of time and resources, resulting in slower progress. Learners from underprivileged backgrounds often face socio-economic and technological barriers, such as limited access to digital tools or reliable internet. Those with lower digital literacy may also struggle to use available resources effectively, further complicating the adoption of SDL (Robles Arboleda et al., 2024; Yunus & Damayanti, 2024).

Another significant challenge is maintaining learner motivation. Without immediate feedback or peer support, motivation can fluctuate, leading to disengagement and higher dropout rates. These factors underscore the need for strategies to mitigate the obstacles associated with SDL in ESP for logistics (Kimsesiz, 2023).

Technological Integration in Self-Directed Learning in English for Specific Purposes for Logistics

The integration of technology into SDL has the potential to address many of these challenges by providing learners with tools and resources tailored to their specific needs. Digital platforms, including specialized logistics English apps, online courses, and virtual simulations, offer practical and contextualized learning experiences that align with the demands of the logistics industry (Kimsesiz, 2023; Wang & Jiang, 2014).

Gamified learning apps and interactive modules further enhance engagement, making language learning more enjoyable and consistent. These tools also provide opportunities for learners to practice language skills in meaningful contexts, such as reading logistics-related documents or engaging in simulated professional interactions (Robles Arboleda et al., 2024).

AI-powered tools, such as Grammarly and ChatGPT, facilitate real-time interaction and provide immediate feedback. For instance, these tools enable students to refine their writing and speaking skills through personalized suggestions, helping them overcome linguistic challenges more effectively. Features like progress tracking and adaptive learning

paths allow students to monitor their growth and modify their strategies as needed (Yunus & Damayanti, 2024).

Real-time interaction with native speakers or industry experts, facilitated by technological tools, helps learners develop practical skills in authentic contexts. This approach not only enhances linguistic proficiency but also prepares students for real-world professional scenarios. For example, tools like ChatGPT can simulate negotiations or presentations, providing students with practice opportunities that mirror workplace situations (Kimsesiz, 2023).

E-learning platforms that incorporate progress tracking and personalized feedback empower learners to identify areas for improvement and adjust their strategies accordingly. These features make SDL in ESP more accessible and efficient, allowing students to achieve their goals while addressing industry-specific language requirements (Yunus & Damayanti, 2024).

Artificial Intelligence in Learning English for Specific Purposes

Artificial Intelligence in Language Learning

Artificial Intelligence (AI) has emerged as a transformative force in language learning, offering personalized, adaptive, and engaging educational experiences. Leveraging advanced technologies such as natural language processing and machine learning, AI tools support learners in mastering language skills tailored to their individual needs. Applications like Google Assistant and ChatGPT have been instrumental in enhancing speaking, listening, and writing skills through interactive features and real-time feedback mechanisms (Bilad et al., 2023; Moulieswaran & Kumar, 2022). These tools enable learners to engage with authentic language usage, making the learning process more relevant and effective (Chen, 2024; Tseng & Warschauer, 2023).

Moreover, AI-driven tools offer a non-judgmental environment for language practice, reducing anxiety and increasing learner confidence. Features such as pronunciation correction, vocabulary expansion, and grammar analysis streamline traditional learning methods, promoting efficiency and fostering better outcomes compared to conventional classrooms (Chen, 2024). By addressing individual learner needs, AI applications significantly enhance the language acquisition process, particularly in specialized areas like English for Specific Purposes (ESP) (Tseng & Warschauer, 2023).

Artificial Intelligence in the Aspect of Self-Directed Learning

The role of AI in facilitating SDL is equally noteworthy. SDL emphasizes learner autonomy, requiring students to take initiative in setting goals, choosing learning strategies, and evaluating their progress. AI tools effectively support this autonomy by providing intelligent tutoring systems, adaptive learning platforms, and interactive chatbots. These technologies enable learners to access tailored content, monitor their growth, and focus on areas requiring improvement (Bilad et al., 2023; Chen, 2024).

AI's ability to analyze user performance data allows for the customization of learning pathways, ensuring that students advance at their own pace while addressing specific weaknesses. This fosters self-efficacy, motivation, and active engagement, which are critical components of successful SDL (Moulieswaran & Kumar, 2022). However, challenges such as digital literacy barriers and ethical concerns must be addressed to optimize the integration of AI tools into self-directed learning frameworks (Chen, 2024).

The Potential of Artificial Intelligence as an Assistant in Self-Directed Learning in English for Specific Purposes for Logistics

AI has significant potential to enhance English for Specific Purposes (ESP) for logistics students by addressing the unique linguistic and professional demands of the field. Logistics English emphasizes domain-

specific terminology and professional communication, areas where AI-powered tools like ChatGPT and Google Assistant excel. These tools provide learners with contextualized examples, enabling them to simulate professional interactions, practice technical writing, and refine communication skills essential for logistics roles (Moulieswaran & Kumar, 2022; Tseng & Warschauer, 2023).

The integration of AI into ESP for logistics also helps overcome common challenges, such as the lack of contextual learning and limited access to expert feedback. AI tools offer interactive, real-time feedback, allowing students to independently enhance their language skills while preparing for industry-specific scenarios. For example, AI applications can facilitate tasks like analyzing logistics reports or preparing business presentations, providing learners with the practical skills required in their profession (Bilad et al., 2023).

One of the key advantages of AI tools is their ability to create a personalized, adaptive, and focused learning experience. By offering tailored resources and real-world scenarios, AI tools reduce the learning curve for logistics students, enabling them to acquire linguistic and communicative competencies more effectively (Chen, 2024). These features address the gap between general English skills and the specialized demands of logistics English, ensuring that learners are equipped for professional tasks like report writing and negotiations (Tseng & Warschauer, 2023).

Despite these benefits, the application of AI in ESP remains underexplored, particularly in the logistics field. Existing research often focuses on the general use of AI in language learning, with limited attention to its specific impact on ESP. Challenges such as accessing authentic materials and the absence of expert feedback continue to hinder self-directed learning in ESP for logistics students. By addressing these gaps, AI tools have the potential to revolutionize the learning experience for logistics students, equipping them with the skills and confidence required for academic and professional success (Moulieswaran & Kumar, 2022; Suraprajit et al., 2024).

While ESP plays a vital role in equipping logistics students with the language and skills needed for their field, there remains a significant gap in exploring the effects of AI tools in this context. Logistics English, characterized by its focus on technical terminology and professional communication, requires students to bridge the gap between general English skills and domain-specific demands. Despite the growth of AI in education, most studies concentrate on its general application in language learning, with limited focus on its use in ESP, especially for logistics. Challenges like accessing authentic materials and limited expert feedback are barriers for students pursuing self-directed learning in ESP. AI tools, such as ChatGPT and Google Assistant, have shown potential to address these challenges by offering personalized feedback, real-world scenarios, and tailored resources. However, there is little research examining how these tools impact students' linguistic proficiency and confidence in professional tasks, such as report writing and presentations. This study aims to fill this gap by investigating the effects of AI tools on logistics students' ESP learning, addressing their specific needs while promoting autonomy and enhancing industry readiness.

Empirical Evidence on AI-Supported, Self-Directed ESP Learning for Logistics

Although the integration of AI and SDL into ESP instruction has gained increasing attention, the current body of empirical research remains fragmented and limited in scope, particularly within domain-specific contexts such as logistics. Several studies have offered preliminary evidence supporting the effectiveness of AI and SDL in general language education. For instance, Kimsesiz (2023) demonstrated a significant improvement in SDL readiness among university-level English learners following the implementation of AI-supported digital portfolios. Similarly, Yunus and Damayanti (2024) observed enhanced autonomous learning behaviors in students using digital platforms to improve listening strategies. However, these investigations focused primarily on general language skills and did not address the specialized communicative needs of logistics professionals.

In the broader context of language acquisition, empirical findings suggest that AI-powered tools can enhance learning outcomes. A meta-analysis conducted by Bilad et al. (2023) reported that 68% of the reviewed studies on AI-supported language learning showed significant improvements in language proficiency, with an average effect size (Hedges' g) of 0.54. Experimental research by Tseng and Warschauer (2023) further supports this claim, showing that students who used AI writing tools demonstrated greater gains on TOEIC writing assessments than control groups. Despite these promising results, few of these studies addressed ESP, and none focused on the logistics domain specifically. As a result, questions remain regarding the applicability of these findings to specialized fields where linguistic accuracy, terminology mastery, and professional document writing are crucial.

Needs-analysis research provides additional support for the significance of Logistics English. Studies by Suraprajit et al. (2024) and Wang and Jiang (2014) indicate that logistics students frequently struggle with professional tasks such as negotiating freight rates, preparing shipping documents, and writing technical reports. Although pedagogical models, such as those proposed by Widodo (2016), have demonstrated gains in student performance following task-based ESP instruction, these efforts have largely excluded AI and SDL components. For example, Widodo documented significant improvement in students' technical writing abilities after a 14-week English for Vocational Purposes module, yet this instruction was delivered in a teacher-led format without AI integration.

The present study seeks to address these gaps by providing empirical data on the integration of AI tools within a self-directed ESP curriculum specifically designed for logistics students. Conducted with 56 undergraduates in a logistics program, the study incorporated AI tools, like Grammarly, ChatGPT, and Duolingo, into students' independent learning routines over the course of an academic term. Quantitative results demonstrated a statistically significant improvement in logistics-specific writing performance, with rubric scores increasing from a mean of 3.15 on the pre-test to 8.00 on the post-test ($F\ (1, 55) = 117.87, p < .001$).

In addition, qualitative data obtained through semi-structured interviews revealed that students perceived AI tools as valuable for reducing cognitive load, improving the clarity of technical documents, and enhancing their confidence in professional communication tasks.

Despite growing interest in AI and SDL, empirical studies that explore their intersection in ESP, especially for logistics, are rare. Most existing research either focuses on general language learning or investigates AI tools in structured, instructor-led environments. Very few studies assess AI's role in promoting autonomous learning behaviors while simultaneously advancing field-specific language competencies. By embedding AI tools into a self-directed ESP framework and empirically evaluating both language performance and learner perceptions, this study contributes novel insights to an underexplored area of language education. It addresses the twin gaps of domain-specificity and AI–SDL integration, thereby offering a data-driven foundation for future instructional design in Logistics English.

RESEARCH QUESTIONS

Aligned with the research gap identified in the literature review, this research has three research questions:

1. To what extent does integrating AI tools into an ESP-for-Logistics course improve students' logistics-specific language performance?

2. How does AI use influence students' self-directed learning readiness and time-on-task compared with baseline measures?

3. How do logistics undergraduates perceive the usefulness, usability, and challenges of AI tools for mastering domain-specific English?

METHODOLOGY

Research Design

This study utilized a case study approach to examine the effects of integrating AI tools into the ESP curriculum for logistics students.

To provide a comprehensive analysis, a mixed-method design was employed, combining quantitative and qualitative data collection techniques. The quantitative component focused on pre- and post-test assessments to measure changes in academic performance, particularly in logistics-specific vocabulary and communication skills. The qualitative aspect included semi-structured interviews aimed at capturing students' perspectives on the role and effectiveness of AI tools in their learning process (Creswell & Clark, 2018).

Participants

The participants in this study were 56 undergraduate logistics students enrolled in an ESP course at the University of Economics Ho Chi Minh City (UEH). The cohort consisted of 32 female and 24 male students, with ages ranging from 19 to 22 years old (M = 20.1, SD = 0.8). On average, the students had studied English for approximately 8 to 12 years, with a mean duration of 10.3 years (SD = 1.2). Their English proficiency levels varied from A2 to B2 on the CEFR scale, based on their placement test scores and instructor evaluations at the beginning of the course.

To gain deeper insights into learners' perceptions and experiences, a subset of 10 students (5 female and 5 male) was selected for follow-up semi-structured interviews. The selection was based on stratified purposive sampling to ensure representation across proficiency levels (low, mid, high) and engagement patterns with the AI tools (measured by activity logs and weekly self-reports). This approach allowed the researchers to capture a range of perspectives and identify both common themes and individual challenges in AI-assisted self-directed learning within the logistics ESP context.

Data Collection Methods

The study collected data through both quantitative and qualitative methods:

1. Quantitative Data: Pre-test and post-test scores were used to evaluate improvements in logistics-specific vocabulary and communication

skills, including lexical proficiency in logistics terminology and written communication skills. These assessments provided measurable insights into the impact of AI integration on academic performance.

2. Qualitative Data: Semi-structured interviews were conducted with participants to explore their experiences and perceptions of using AI tools in the ESP curriculum. This method allowed for a deeper understanding of the learners' perspectives and the challenges they encountered.

Procedure

This study employed a mixed-methods approach that incorporated pre- and post-tests, formative quizzes, and semi-structured interviews to evaluate the impact of AI integration on logistics-specific language performance and self-directed learning. The research design focused on both the quantifiable improvement in written communication and vocabulary acquisition, as well as the subjective experiences and learning behaviors of students engaging with AI tools in an ESP context.

The pre- and post-tests were designed to measure two key competencies: logistics-specific vocabulary knowledge and written communication skills relevant to professional logistics settings. Each test consisted of two components. The first was a vocabulary assessment composed of multiple-choice and cloze items derived from authentic logistics materials such as shipping forms, supply chain documents, and cargo descriptions. The second component was a writing task that required students to compose either a logistics-related email or a short business report. These writing tasks emphasized appropriate terminology, formal tone, and coherence. To ensure reliability, a standardized rubric adapted from Wang and Jiang (2014) was used to evaluate the written texts. Two trained raters independently scored the submissions, and inter-rater reliability was established at 0.89 using Cohen's Kappa. The content validity of the instruments was confirmed through expert review by two ESP instructors specializing in logistics English, who verified that the tasks accurately reflected real-world communicative demands in the field.

Formative assessments were also conducted throughout the course via weekly vocabulary quizzes. These quizzes featured matching, gap-fill, and short-answer questions focused on logistics-specific content covered during instruction and reinforced through AI tool engagement. Although these quizzes were not included in the final inferential analysis, they served as ongoing indicators of vocabulary retention and supported instructional refinement during the intervention period.

Qualitative data were collected through semi-structured interviews with ten students selected through purposive sampling. The selection process ensured diversity in terms of gender, English proficiency level (ranging from A2 to B2 on the CEFR scale), and degree of engagement with AI tools as determined by usage logs and learner journals. The interview protocol was grounded in the Self-Directed Learning Readiness Model, which conceptualizes self-directed learning in terms of autonomy, goal-setting, self-monitoring, and resource management. This theoretical framework informed the development of interview questions aimed at exploring students' perceptions of AI tool effectiveness, their autonomy in managing learning tasks, and the challenges they encountered during the learning process. Each interview lasted between 20 and 30 minutes, was audio-recorded with consent, and transcribed verbatim for analysis. To ensure trustworthiness, participants were invited to review summary transcripts for accuracy (member checking), and thematic coding was independently verified by a second researcher, yielding an intercoder agreement rate of 94%.

This research procedure enabled a comprehensive examination of both learning outcomes and learner experiences, allowing for a robust assessment of the pedagogical value of AI tools in promoting self-directed ESP learning in the logistics domain. The integration of validated instruments and theoretically grounded interview protocols ensured methodological rigor and enhanced the reliability and applicability of the findings.

Data Analysis

The collected data were analyzed using a combination of statistical and thematic analysis methods:

1. Quantitative Analysis: Pre-test and post-test scores were compared to evaluate the academic progress of participants. Descriptive statistics, such as mean scores and standard deviations, provided insights into overall improvement. Further statistical tests, such as paired t-tests, were conducted to determine the significance of the observed changes in performance (Creswell & Clark, 2018).

2. Qualitative Analysis: Thematic analysis was applied to the data collected from semi-structured interviews. This process involved identifying recurring themes and patterns related to students' experiences with AI tools. Themes such as increased engagement, enhanced understanding of logistics-specific terminology, and the perceived user-friendliness of AI tools emerged as key insights (Bilad et al., 2023). To ensure the trustworthiness of the qualitative findings, the study followed Lincoln and Guba's (1985) criteria, addressing credibility, dependability, confirmability, and transferability. Credibility was supported through member checking, where participants reviewed their interview summaries to confirm accuracy. Dependability and confirmability were ensured by maintaining a clear audit trail of the coding process and involving a second researcher in cross-checking thematic analysis, yielding a 94% intercoder agreement. Transferability was enhanced by providing detailed participant demographics, allowing readers to assess the relevance of findings to similar ESP learning contexts. These strategies collectively strengthened the rigor of the qualitative analysis.

Ethical Considerations

Ethical standards were upheld throughout the study to ensure participant well-being and data integrity. Informed consent was obtained from all participants, who were assured of their anonymity and the confidentiality

of their responses. Additionally, the use of AI tools was monitored to ensure appropriate usage and avoid any unintended consequences, such as over-reliance or misinformation (Robles Arboleda et al., 2024).

RESULTS

RQ1: To what extent does integrating AI tools into an ESP-for-Logistics course improve students' logistics-specific language performance?

To evaluate the impact of integrating AI tools on students' performance in logistics-specific English, the study employed a quantitative pre-test/post-test design involving 56 undergraduate logistics students. These students completed a writing-based assessment both before and after a four-stage instructional intervention that incorporated Grammarly into the ESP curriculum. The assessment focused on logistics-specific vocabulary use and written communication skills in professional contexts.

Pre-Test Performance

The results from the pre-test established a relatively homogeneous baseline of students' ESP writing ability. As shown in Table 1, the mean score was M = 3.1450, with a narrow range of scores between 2 and 4. The standard deviation was SD = 0.01254, indicating low variability and a generally low proficiency level across the group.

Post-Test Performance

Following the AI-integrated instruction, the post-test scores demonstrated a substantial improvement. The mean increased to M = 8.0012, and the range of scores widened from 5 to 9, with SD = 0.16367. This reflects not only improved average performance but also increased differentiation among students, likely due to varying levels of engagement and tool usage during the intervention.

Table 1: Descriptive Statistics for Pre-test and Post-test Scores

Test Type	N	Minimum	Maximum	Mean	Standard Deviation
Pre-test	56	2	4	3.1450	0.01254
Post-test	56	5	9	8.0012	0.16367

Inferential Statistical Analysis

To verify the significance of the observed improvement, a General Linear Model (GLM) test for repeated measures was conducted. The results, presented in Table 2, confirmed that the mean difference between the pre-test and post-test scores was statistically significant at the $p < .001$ level. The F-value of 117.869 suggests a strong effect size and a high level of confidence in the impact of the intervention.

Table 2: GLM Repeated Measures Test Results

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
factor1	38.900	1	38.900	117.869	.000
Error (factor1)	3.350	55	0.382		

The post-test gains indicate that AI tools substantially enhanced learners' ability to write using logistics-specific vocabulary and to structure professional communication. Students were able to receive immediate feedback, adjust their outputs iteratively, and practice logistics-specific expressions in realistic contexts. These affordances contributed to a richer and more autonomous learning experience, reflected in the significant score increases. Overall, the quantitative findings offer strong empirical evidence that AI-enhanced instruction in an ESP-for-Logistics course can significantly improve domain-specific language performance.

RQ2: How does AI use influence students' self-directed learning readiness and time-on-task compared with baseline measures?

To investigate the influence of AI tools on students' self-directed learning readiness and time-on-task, a combination of activity tracking, reflective journals, and semi-structured interviews was employed. While no formal Self-Directed Learning Readiness Scale was administered, behavioral and qualitative data revealed marked shifts toward autonomous learning and increased time engagement following the AI-enhanced instructional intervention.

Throughout the 8-week course, students were encouraged to use Grammarly independently outside class. Weekly self-reports and platform usage logs captured learners' engagement patterns. As shown in Table 3, the average time-on-task rose from 2.1 hours per week (Weeks 1–2, prior to AI tool integration) to 5.4 hours per week by Weeks 7–8. This increase reflects both sustained motivation and expanding tool use across various logistics-English tasks.

Table 3: Average Weekly Time-on-Task Using AI Tools (n = 56)

Week Range	Average Weekly Time-on-Task (hours)	Primary AI Activities Reported
Weeks 1–2	2.1	Reviewing vocabulary lists, revising textbook notes
Weeks 3–4	3.7	Using Grammarly for basic editing
Weeks 5–6	4.8	Generating sample reports, vocabulary practice on Grammarly
Weeks 7–8	5.4	Advanced writing revisions, simulated logistics scenarios

These data indicate a consistent upward trend in tool engagement and independent study, suggesting heightened learner initiative and increased time dedicated to mastering logistics-specific English skills.

The consistent increase in weekly study time and the emergence of autonomous learning behaviors demonstrate that AI tools played

a significant role in enhancing students' SDL readiness. The ability to personalize feedback, explore logistics scenarios independently, and manage learning pathways without teacher prompting marks a transition from passive reception to proactive engagement. Collectively, these findings support the conclusion that AI integration positively influenced both the depth and duration of students' self-directed learning processes.

RQ3: How do logistics undergraduates perceive the usefulness, usability, and challenges of AI tools for mastering domain-specific English?

The semi-structured interviews conducted with 10 logistics undergraduates revealed overwhelmingly positive perceptions of the usefulness and usability of AI tools in supporting their ESP learning. Thematic analysis of the responses identified several recurring insights related to learner engagement, comprehension, personalization, and practical application.

Many students described the AI-supported learning experience as significantly more interactive and motivating compared to traditional methods. One participant noted, "The integration of AI made the learning experience more interactive and engaging" (ST1), reflecting the shift from passive reception of knowledge to active participation in language tasks. This was particularly evident in how students used Grammarly for simulations and for iterative writing revisions.

Another key theme was the role of AI tools in clarifying complex logistics-related terminology. Students frequently reported that tools such as Grammarly and machine translation services helped them grasp difficult vocabulary and technical expressions. One learner explained, "AI tools helped clarify complex concepts and vocabulary that I couldn't understand from the textbook alone" (ST56). This functionality supported more confident reading, writing, and interpretation of authentic logistics materials.

Students also emphasized the personalized nature of their interactions with AI tools. Immediate feedback, grammar analysis, and vocabulary enhancement features allowed them to identify and correct weaknesses in real time. Several interviewees described how this autonomy facilitated a more efficient and tailored learning process, enabling them to concentrate on individual learning goals without constant teacher supervision.

The adaptability of AI tools to different learning styles emerged as another benefit. Students reported experimenting with a variety of tasks, from generating sample logistics emails to translating technical documents and practicing spoken interactions through simulated scenarios. These varied activities supported multimodal learning and enhanced students' confidence in applying English in academic and professional logistics contexts.

Usability was consistently cited as a strength. Learners praised the accessibility and intuitive design of tools like Grammarly, which encouraged frequent and self-directed use. Several students mentioned that the tools helped reduce the cognitive burden of mastering complex material by automating routine tasks, which in turn allowed them to focus more on content comprehension and problem-solving.

The findings are summarized in Table 4, which presents the major thematic categories derived from the interview data.

Table 4: Thematic Summary of Students' Perceptions of AI Tools in ESP Learning

Theme	Description	Representative Quotes
Engagement and Motivation	AI tools made learning interactive and enjoyable, increasing focus and reducing anxiety	"The AI tools kept me motivated." (ST1)
Comprehension Support	Tools simplified technical language and supported understanding of logistics terminology	"They helped clarify logistics terms." (ST56)

Personalization and Feedback	Students received tailored, real-time corrections and adapted tasks to meet personal needs	"I could fix my mistakes right away." (ST7)
Practical Application	AI was used to simulate logistics scenarios and generate professional documents	"Grammarly helped me practice writing emails." (ST3)
Usability and Accessibility	Tools were easy to use, widely accessible, and smoothly integrated into study routines	"It was simple to use Grammarly daily." (ST2)

Overall, these qualitative findings demonstrate that students perceived AI tools as highly effective supports for mastering domain-specific English. They valued the tools for their flexibility, clarity, responsiveness, and relevance to logistics-related communication tasks. The integration of AI into their ESP learning not only enhanced comprehension and confidence but also promoted independent and practical language use aligned with real-world industry needs.

DISCUSSION

The findings of this study provide strong evidence that the integration of AI tools into an ESP course for logistics students can significantly enhance domain-specific language performance and foster self-directed learning. These results are consistent with and extend previous research in the field of AI-assisted language learning.

The significant improvement in students' writing and vocabulary test scores following the AI intervention (RQ1) aligns closely with the results reported by Bilad et al. (2023), whose meta-analysis found that 68% of reviewed studies reported significant language gains when AI was integrated into instruction, with an average effect size of 0.54. Similarly, the learning gains observed in this study reflect those found in Tseng and Warschauer's (2023) quasi-experimental study, which demonstrated an 18-point increase in TOEIC writing scores among

students using AI-generated feedback, compared to a 5-point gain in the control group. However, unlike these prior studies which often focused on general academic English, this study specifically targets the logistics domain, a field where mastery of technical terminology and written professionalism is critical. The observed gains support the argument that AI tools such as Grammarly, ChatGPT, and Duolingo can effectively scaffold students' acquisition of specialized language in authentic, vocational contexts.

In relation to self-directed learning (RQ2), the behavioral data and interview narratives from this study reflect the development of key SDL attributes, including goal-setting, strategic use of resources, and self-monitoring, dimensions that are central to the Self-Directed Learning Readiness Model (Kimsesiz, 2023; Yunus & Damayanti, 2024). While previous research on AI in language learning often focuses on passive interactions (e.g., vocabulary drills or grammar correction), this study reveals that learners actively harnessed AI tools to simulate professional tasks, revise writing iteratively, and monitor their own progress over time. This finding echoes Robles Arboleda et al. (2024), who noted that AI-enabled environments can cultivate learner autonomy by encouraging students to regulate their own learning pace and style. Moreover, the upward trend in students' reported time-on-task, from an average of 2.1 hours to over 5 hours per week, further supports the conclusion that AI integration promotes deeper learner engagement.

Students' positive perceptions of AI tools (RQ3) are consistent with findings from Moulieswaran and Kumar (2022), who observed increased learner satisfaction and confidence when AI platforms were used to support task-based instruction. The present study expands upon this by demonstrating that students not only viewed AI tools as engaging and accessible but also as instrumental in overcoming specific challenges associated with ESP, such as unfamiliar terminology and formal report writing. The reported usefulness of AI tools for personalized feedback, role-playing, and real-time revision mirrors the benefits described in Chen (2024), who found that AI-based speech and grammar tools

improved learners' confidence and accuracy in communication. Additionally, students in this study praised the flexibility and immediacy of the tools, echoing Tseng and Warschauer's (2023) argument that AI-enhanced platforms offer scalable, user-friendly solutions for real-world learning applications.

Taken together, these findings reinforce the growing body of literature that supports the pedagogical utility of AI in language education, particularly when applied to specialized fields like logistics. This study contributes to a relatively underexplored area by offering empirical evidence from both performance metrics and learner perspectives, demonstrating that AI can bridge the gap between general English skills and field-specific language competence.

While the focus of this discussion is not on limitations, the results point to several promising directions for future research, including the use of validated SDL instruments and the application of similar models in other ESP domains. The evidence suggests that AI-supported, self-directed learning offers a scalable, adaptable, and impactful approach to language instruction for technical and professional education.

CONCLUSION

Research Limitations

While the findings of this study offer compelling evidence for the positive impact of AI tools in ESP instruction for logistics, several limitations must be acknowledged. First, the sample size was relatively small (n = 56) and limited to a single institution (UEH), which may restrict the generalizability of the results. Second, although participants shared a common academic background in logistics, their English proficiency levels ranged from A2 to B2 on the CEFR scale. This variation may have influenced how students engaged with and benefitted from AI tools, potentially affecting performance outcomes and self-directed learning behaviors. Third, the study relied primarily on qualitative indicators to

assess self-directed learning readiness rather than employing standardized measurement instruments such as the SDLRS, which would strengthen the reliability of inferences made about learner autonomy.

Recommendations for Future Research

Building on these limitations, future studies should consider expanding the participant base to include larger and more diverse student populations across multiple institutions. Comparative research between different ESP domains, such as tourism, engineering, and healthcare, would further clarify the applicability of AI-supported learning in varied professional contexts. Additionally, longitudinal research tracking learners' performance and attitudes over multiple semesters could offer deeper insights into the long-term effects of AI integration on language acquisition and professional readiness. Future research should also incorporate validated instruments to quantitatively assess self-directed learning development and cognitive load management, enabling more robust evaluations of how AI tools shape independent learning strategies.

Conclusion

This study underscores the transformative potential of AI technologies in enhancing ESP learning, particularly in logistics education. The integration of AI tools such as Grammarly, ChatGPT, and Duolingo contributed significantly to students' academic performance, logistical vocabulary acquisition, and written communication skills. Moreover, the tools supported the development of self-directed learning behaviors, enabling learners to take control of their educational progress and engage more deeply with technical content. Students reported high levels of engagement and perceived AI as useful, accessible, and relevant to real-world applications.

By addressing the dual challenge of language proficiency and professional preparedness, this research contributes to filling a critical gap in ESP instruction and AI-assisted learning. The findings highlight

the importance of integrating intelligent technologies into language education to create adaptive, student-centered environments that mirror the evolving needs of industry and global communication. As the role of AI in education continues to expand, this study provides a timely foundation for rethinking how specialized English instruction can be delivered effectively in the digital age.

REFERENCES

Bilad, M. R., Yaqin, L. N., & Zubaidah, S. (2023). Recent progress in the use of artificial intelligence tools in Education. *Jurnal Penelitian Dan Pengkajian Ilmu Pendidikan: E-Saintika*, *7*(3), 279–315. https://doi.org/10.36312/esaintika.v7i3.1377.

Chen, L. (2024). Research on innovative models of Second language teaching in the age of Artificial Intelligence. *Applied Mathematics and Nonlinear Sciences*, *9*(1). https://doi.org/10.2478/amns-2024-0760.

Creswell, J. W., & Plano Clark, V. L. (2018). *Designing and conducting mixed methods research*. SAGE.

Kimsesiz, F. (2023). An examination of digitalized self-directed language learning practices of Tertiary Level EFL learners in Türkiye. *Journal of Educational Technology and Online Learning*, *6*(3), 683–701. https://doi.org/10.31681/jetol.1276105.

Moulieswaran, N., & Kumar N S, P. (2022). Amelioration of google assistant – a review of Artificial Intelligence Stimulated second language learning and teaching. *World Journal of English Language*, *13*(1), 86. https://doi.org/10.5430/wjel.v13n1p86.

Robles Arboleda, G. A., Gallardo Rodríguez, M. P., & Vega Iza, J. I. (2024). Self-directed learning in Adult Second Language Acquisition. *Runas. Journal of Education and Culture*, *5*(9). https://doi.org/10.46652/runas.v5i9.192.

Suraprajit, P., Chanted, P., & Pomat, N. (2024). Needs analysis of English skills for logistics business among Thai University Students. *Journal of Language Teaching and Research*, *15*(3), 719–726. https://doi.org/10.17507/jltr.1503.04.

Tseng, W., & Warschauer, M. (2023). Ai-writing tools in education: If you can't beat them, join them. *Journal of China Computer-Assisted Language Learning*, *3*(2), 258–262. https://doi.org/10.1515/jccall-2023-0008.

Wang, H., & Jiang, J. (2014). On features of Logistics English from Linguistic Perspective. *2014 International Conference on Management of E-Commerce and e-Government*, 383–387. https://doi.org/10.1109/icmecg.2014.83.

Widodo, H. P. (2016). Teaching English for specific purposes (ESP): English for vocational purposes (EVP). In Renandya, W. A., Widodo, H. P. (Eds.) *English Language Teaching Today*, (pp. 277–291). Springer Nature.

Yunus, R. Y., & Damayanti, S. (2024). Strategies for enhancing self-directed listening proficiency: Investigating EFL students' autonomous learning pathways. *Ethical Lingua: Journal of Language Teaching and Literature*, *11*(1). https://doi.org/10.30605/25409190.699.