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Exploring Students' Use of AI Translation and Paraphrasing Tools during Academic Reading

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The increasing availability of AI translation and paraphrasing tools offers new possibilities for supporting English as a Foreign Language (EFL) students' academic reading. This issue is particularly relevant in university contexts where students are required to engage with complex English academic texts yet often encounter linguistic and conceptual difficulties. This study aims to investigate how university students use AI translation and paraphrasing tools across the before-reading, during-reading, and after-reading stages of academic reading and to examine how these stage-specific uses support students' meaning-making processes. Using a qualitative exploratory design, data were collected from 20 university students who were familiar with AI-assisted reading practices through think-aloud protocols, reading journals, and semi-structured interviews, and were analyzed thematically. Findings reveal that students engage with AI tools in a strategic and reflective manner, employing translation for lexical support, paraphrasing for structural simplification, and both tools for reflective consolidation. Students' use of AI was stage-specific: pre-reading translation enabled previewing and activation of prior knowledge; during reading, paraphrasing supported comprehension monitoring and verification; after reading, students consolidated understanding through summarization and clarification. The study highlights that AI tools function as both cognitive and metacognitive scaffolds, extending learners' capacity to navigate complex academic texts while promoting learner agency and self-directed reading. These insights offer practical implications for integrating AI tools into academic literacy instruction and suggest avenues for future research on longitudinal effects, disciplinary differences, and adaptive strategies for diverse proficiency levels.

Keywords: AI translation, academic reading, EFL learning, paraphrasing tools, reading strategies

INTRODUCTION

Academic reading is a central component of university-level learning, particularly in contexts where English is used as a medium for accessing disciplinary knowledge. For many students, engaging with academic texts in English involves navigating complex linguistic features, dense informational content, and unfamiliar rhetorical structures

(Dardjito et al., 2023; Olson et al., 2023). These challenges are not limited to vocabulary or grammar but extend to higher-level processes such as inferencing, synthesizing ideas, and constructing meaning across texts. As a result, students often rely on various forms of mediation to support comprehension during academic reading, including dictionaries, glossaries, summaries, and peer discussion (Aghazadeh et al., 2022; Walden & Khan, 2025). In recent years, advances in artificial intelligence have introduced new forms of digital mediation that are increasingly embedded in students' everyday academic practices.

Among these developments, AI-powered translation and paraphrasing tools have become particularly prominent (Aleedy et al., 2025). Unlike earlier rule-based translation systems, contemporary AI tools generate context-sensitive translations and paraphrases that approximate natural language use (Naveen & Trojovský, 2024; Wu et al., 2022). These tools are now easily accessible through web platforms, mobile applications, and integrated reading environments. As a result, students can instantly translate unfamiliar segments of text, paraphrase complex sentences, or generate simplified versions of academic discourse with minimal effort (Moneus & Sahari, 2024). This growing accessibility has raised important questions about how such tools are actually used during academic reading and how they shape students' engagement with texts.

Existing discussions around AI translation and paraphrasing in education have often been framed through polarized perspectives. On one hand, concerns have been raised about overreliance, reduced language learning opportunities, and threats to academic integrity (Dinh, 2025; Kruk & Kałużna, 2025). On the other hand, proponents argue that AI tools can function as scaffolding devices that support comprehension, reduce cognitive load, and enable learners to engage with texts that might otherwise be inaccessible (Lin et al., 2025; Yuan, 2025). While both perspectives offer valuable insights, they tend to focus on outcomes or ethical implications rather than on the processes through which students interact with texts when using AI tools (Kim et al., 2025; Nguyen et al., 2024). As a result, there remains limited empirical understanding of how students actually integrate AI translation and paraphrasing tools into their academic reading practices.

Reading research has long emphasized that comprehension is not a single act but a process that unfolds across multiple stages. The before-reading stage involves activating prior knowledge, previewing text structure, and setting reading purposes (Hattan, 2024). During-reading processes include monitoring comprehension, resolving lexical and syntactic difficulties, and constructing local and global meaning (Walldén, 2022). After-reading activities often focus on consolidating understanding through summarization, reflection, and evaluation of the text (Gebremariam & Weldeyohannes, 2025). These stages are not strictly linear but interact dynamically as readers move back and forth between text and interpretation (Grabe & Stoller, 2020). Understanding how AI tools are used across these stages offers a productive lens for examining their role in academic reading beyond simplistic notions of assistance or dependency.

Despite the widespread availability of AI translation and paraphrasing tools, research has paid limited attention to their stage-specific use during academic reading. Many studies rely on self-report surveys that capture general attitudes toward AI tools or measure perceived usefulness without examining how tools are employed at different moments of the reading process (Delcker et al., 2024; Fošner, 2024). Other studies focus on writing outcomes, such as paraphrasing quality or text revision, leaving reading practices

comparatively underexplored (Mohammad, 2024; Sawaki et al., 2024). Moreover, when reading is addressed, AI tools are often treated as monolithic aids rather than as flexible resources that students may appropriate in diverse ways depending on their reading goals and challenges.

A qualitative, process-oriented perspective is therefore needed to illuminate how students use AI translation and paraphrasing tools before, during, and after academic reading. Such an approach allows researchers to capture students' decision-making processes, their interactions with texts and tools, and the meanings they assign to AI-mediated reading practices (Silvola et al., 2025; Thongsan & Anderson, 2025). Rather than asking whether AI tools are beneficial or harmful, this perspective foregrounds how students strategically integrate these tools into their reading activities and how this integration shapes their construction of meaning. This, as stated by Wilson et al. (2024), aligns with sociocognitive and sociocultural views of reading, which conceptualize comprehension as an activity mediated by tools, languages, and social practices.

In addition, academic reading often involves multilingual resources, particularly for students who draw on their first language to support comprehension in English. AI translation tools, in this sense, can be understood as mediational artifacts that enable flexible movement across languages during reading (Kruk & Kałużna, 2025; Ou et al., 2024). Similarly, paraphrasing tools may function as interpretive devices that reframe complex academic language into more accessible forms (Alarcon et al., 2023; Javourey-Drevet et al., 2022). Examining these practices qualitatively can contribute to ongoing discussions about translanguaging, digital mediation, and learner agency in academic literacy development, without assuming predetermined learning outcomes.

The rapid integration of AI tools into students' academic routines also highlights the need for empirical research grounded in authentic reading contexts. Much of what is currently known about AI use in education is based on hypothetical scenarios or controlled tasks, which may not reflect how students actually engage with texts in real academic settings. By focusing on naturally occurring reading activities and students' self-directed tool use, this study aims to provide a more nuanced and ecologically valid account of AI-supported academic reading.

To address these gaps, the present study is guided by the following research questions:

1. How do students use AI translation and paraphrasing tools across the before-reading, during-reading, and after-reading stages of academic reading?
2. How do these stage-specific uses of AI translation and paraphrasing tools support students' meaning-making processes in academic reading?

This study makes several contributions to the literature. First, it extends research on AI in language education by focusing explicitly on academic reading rather than writing or speaking. Second, it adopts a process-oriented framework that captures the temporal dynamics of AI tool use across different stages of reading. Third, by employing a qualitative approach, it provides rich descriptions of students' interactions with texts and tools, offering insights that are often obscured in survey-based research. Finally, the study contributes to broader discussions on digital mediation and academic literacy by illustrating how AI translation and paraphrasing tools function as resources that students actively appropriate to navigate the demands of academic reading.

LITERATURE REVIEW

Understanding the Mediation of Academic Reading through AI Tools

The use of AI translation and paraphrasing tools in academic reading can be conceptualized as a form of digital mediation that reshapes how learners interact with texts. Academic reading is a cognitively demanding activity that requires the integration of multiple strategies to decode vocabulary, grasp syntactic structures, construct local and global meaning, and relate textual information to prior knowledge (Ghazzoul, 2023; Gruhn et al., 2024; Liu et al., 2025). In this context, AI tools act as mediational artifacts that support cognitive processing by providing immediate access to alternative linguistic representations (Feng, 2025; Zhang & Huang, 2024). Such mediation aligns with sociocultural perspectives in second language acquisition (Poehner & Lu, 2024), which emphasize the role of tools, both human and non-human, in scaffolding learning and facilitating meaning-making.

The theoretical lens for analyzing students' use of AI translation and paraphrasing tools is grounded in reading process theories, particularly the framework that conceptualizes reading as a staged activity encompassing before-, during-, and after-reading processes (Grabe & Stoller, 2020). The before-reading stage involves activating prior knowledge, previewing text structure, and setting reading purposes, all of which shape engagement with the text (Hattan, 2024). During reading, learners monitor comprehension, resolve lexical and syntactic difficulties, and construct coherent mental representations of the text (Walldén, 2022). The after-reading stage involves reflection, summarization, and evaluation, enabling the consolidation of understanding (Gebremariam & Weldeyohannes, 2025). AI translation and paraphrasing tools can operate differently at each stage: for example, translation may help decode meaning before or during reading, whereas paraphrasing may assist during or after reading to reframe and internalize content (Suhardiman et al., 2025; Waluyo & Rouaghe, 2025). Understanding stage-specific usage allows researchers to capture the nuanced ways in which learners integrate technology into their reading strategies.

Moreover, the concept of translanguaging offers an important lens for exploring AI-mediated reading. Learners frequently navigate multiple languages to comprehend academic texts, drawing on L1 resources when L2 comprehension is challenged (Qureshi & Al-Surmi, 2025). AI translation tools extend this translanguaging practice by providing real-time support that can reduce cognitive load while maintaining engagement with L2 texts (Ou et al., 2024). Paraphrasing tools, on the other hand, can be understood as scaffolds that facilitate rephrasing complex academic structures in simpler or contextually appropriate terms (Bacon & Kraus, 2025), thus enhancing both comprehension and linguistic flexibility. Taken together, AI translation and paraphrasing tools exemplify how digital artifacts can mediate language processing and meaning construction in ways that reflect both cognitive and sociocultural dimensions of reading.

Another critical aspect of the analytical lens is learner agency. While AI tools provide potential scaffolding, their effectiveness depends on students' decisions regarding when, how, and why to use them. Self-directed and strategic engagement with AI translation and paraphrasing tools is essential for supporting deeper comprehension rather than fostering passive reliance (Shafiee Rad, 2025). By focusing on learners' active decision-making processes, this study situates AI tools as resources that are appropriated according

to individual reading goals and text demands, rather than as deterministic interventions that automatically produce comprehension gains.

Finally, this lens recognizes the interdependence of affective and cognitive factors. Reading academic texts in a foreign language can be anxiety-inducing, and students' willingness to engage with complex material may be influenced by emotional as well as cognitive factors (Derakhshan et al., 2025). AI tools, by offering immediate support, can reduce frustration, increase confidence, and facilitate sustained engagement (Zhai & Nezakatgoo, 2025). Understanding students' reading practices thus requires attention not only to cognitive strategies but also to affective experiences, as these are intertwined in the process of academic reading.

Insights from Previous Studies on AI-Mediated Reading

Empirical research on AI translation and paraphrasing tools in higher education has primarily focused on writing and grammar correction, with less attention to reading processes. Several studies have examined machine translation as a support for vocabulary comprehension and reading fluency. For example, Murtisari et al. (2024) and (Zhu et al. (2024) highlighted that translation aids can facilitate access to L2 lexical items, enabling learners to maintain reading flow without frequent dictionary consultation. Similarly, Dardjito et al. (2023) noted that learners often use online translation tools selectively to resolve comprehension bottlenecks during academic reading, demonstrating strategic and context-sensitive behavior rather than indiscriminate reliance.

Paraphrasing tools, although studied less extensively, have been investigated mainly in relation to academic writing and plagiarism prevention. Research suggests that paraphrasing tools can assist learners in re-expressing complex ideas and internalizing syntactic patterns, thereby supporting both comprehension and productive language use (Mohammad et al., 2023; Roe & Perkins, 2022). For instance, studies by Perełkiewicz et al. (2025) indicate that paraphrasing tools can facilitate understanding of syntactically dense academic passages by presenting alternative expressions that are semantically equivalent but more accessible. However, research exploring their specific role during reading stages remains limited.

Recent scholarship has begun to examine the integration of AI tools in reading more explicitly. Hu and Zhang (2023) found that bilingual students use translation tools dynamically throughout reading tasks, combining prior knowledge, lexical inference, and tool-generated translations to construct meaning. Similarly, Mohammad et al. (2023) reported that students who engaged with paraphrasing tools during reading were better able to summarize and explain texts in their own words, suggesting that these tools can bridge comprehension and production. However, both studies tend to treat reading as a single-stage activity or focus primarily on translation or paraphrasing in isolation, leaving the staged reading process largely unexamined.

Other studies have highlighted the importance of strategic and reflective use of AI tools. For example, Rakhmetov et al. (2025) emphasize that effective learning with AI tools requires metacognitive awareness, including monitoring understanding, evaluating tool output, and deciding when human input is preferable. This insight reinforces the notion that AI translation and paraphrasing tools are not inherently beneficial but must be

appropriated thoughtfully to support comprehension (Sangkawong et al., 2025). Furthermore, students' affective responses, such as reduced frustration or increased confidence, as mentioned by Charles and Gwilliam (2023), have been noted as significant factors in tool adoption and sustained engagement.

Despite these advances, significant gaps remain. First, few studies examine stage-specific use of AI tools in the reading process, particularly the before-reading, during-reading, and after-reading stages. Second, there is limited qualitative exploration of how students integrate multiple AI tools simultaneously or in combination with other resources. Third, prior research often emphasizes task outcomes, such as vocabulary learning or text production, rather than learners' processes and sense-making experiences. Addressing these gaps requires a design that captures authentic, self-directed engagement with AI translation and paraphrasing tools across reading stages, providing a nuanced understanding of how these technologies are appropriated in real academic contexts.

By focusing on learners' practices, decision-making, and meaning construction, this study contributes to filling these gaps. It examines how AI translation and paraphrasing tools are deployed across the three reading stages, revealing both the strategies students adopt and the cognitive and affective roles these tools play. In doing so, it extends the scholarship on AI-mediated academic reading and offers insights relevant to educators, researchers, and developers interested in digital language learning resources.

METHODS

Research Design

This study adopted a qualitative exploratory design to investigate students' use of AI translation and paraphrasing tools during academic reading and to examine how these uses support meaning-making across the before-reading, during-reading, and after-reading stages. The design was selected to allow for in-depth exploration of learners' naturalistic reading practices, decision-making processes, and interpretive strategies, rather than to measure outcomes or establish causal relationships (Black & Tomlinson, 2025). An exploratory qualitative approach is particularly appropriate for emerging educational technologies (Durgungoz & Durgungoz, 2025), as it enables researchers to capture rich, contextually situated data on how learners appropriate AI tools in real academic reading scenarios.

The study focused on understanding practices and perceptions from the learners' perspective, emphasizing what students do and why they do it while interacting with texts and AI tools. By framing the investigation around the three reading stages, the research design ensured that the analysis could reveal temporal patterns, strategic choices, and stage-specific affordances of AI translation and paraphrasing. This process-oriented approach draws on reading theory and sociocultural perspectives, which conceptualize comprehension as an activity mediated by tools, prior knowledge, and cognitive and affective processes.

Participants

Participants were university students enrolled in English-medium courses that required engagement with academic texts, such as journal articles, textbooks, and technical reports. Participation was voluntary, and all students provided informed consent prior to

data collection. The study intentionally included students with diverse academic backgrounds and varying English proficiency levels, reflecting the heterogeneity typical in higher education settings. No proficiency criteria were imposed beyond active engagement in academic reading tasks, allowing the study to capture a broad spectrum of self-directed AI tool use.

A total of 20 participants were recruited for the study. This sample size was considered sufficient for in-depth qualitative exploration, enabling detailed observation, interviews, and analysis of reading behaviors. Participants were also selected based on their reported familiarity with AI translation and paraphrasing tools, ensuring that they had prior exposure to the technologies under investigation. The AI tools most commonly reported and subsequently observed in this study included AI translation platforms such as Google Translate and DeepL, as well as AI paraphrasing and generative language tools such as QuillBot and ChatGPT. These tools were selected because they represented the applications most frequently used by students in their regular academic reading routines. Ethical considerations were carefully addressed: participants were informed about the purpose of the study, the types of data to be collected, and their right to withdraw at any time without penalty. Anonymity was maintained by assigning pseudonyms and removing identifying information from all transcripts and field notes.

Data Collection

Data collection employed multiple qualitative sources to achieve triangulation and enhance the trustworthiness of the findings (Morgan, 2024). The primary sources included think-aloud protocols, reading journals, and semi-structured interviews. These methods were selected to capture both real-time reading processes and reflective insights into students' strategic use of AI tools.

Think-aloud protocols were conducted while participants engaged with academic texts using AI translation and paraphrasing tools (Tarchi et al., 2025). To preserve ecological validity, participants were not restricted to a single researcher-assigned application; instead, they were allowed to use whichever AI translation or paraphrasing tools they normally relied on during independent academic reading, including Google Translate, DeepL, QuillBot, and ChatGPT. This free-choice mechanism was intentionally adopted to capture authentic decision-making and naturally occurring tool preferences rather than experimentally imposed behavior. Prior to the session, each participant was asked to bring or access an academic English text relevant to their coursework and to read it as they would normally do while verbalizing their thoughts. Whenever they chose to consult an AI tool, they were instructed to articulate why the tool was selected, what textual difficulty triggered the consultation, and how the AI-generated output affected their comprehension. Students were instructed to verbalize their thoughts continuously as they navigated the reading tasks, articulating how and why they decided to use AI translation or paraphrasing, which passages prompted tool use, and how the output influenced their understanding. This approach provided detailed, moment-by-moment evidence of students' strategies across the before-, during-, and after-reading stages, highlighting patterns of engagement with AI tools that would not be captured through self-report alone.

Reading journals were maintained by participants throughout the study. Students documented their experiences, decisions, and reflections after completing reading sessions (Yawson et al., 2025). Journal prompts specifically asked participants to mention

which AI tool they used in each reading stage, why they chose that particular tool, what kind of textual problem it helped them solve, and whether they shifted between tools during the reading process. Prompts guided them to describe the texts they read, AI tools used, specific strategies applied, and challenges encountered at each reading stage. Journals allowed participants to elaborate on cognitive and affective aspects of reading that were difficult to verbalize during think-aloud protocols, offering a richer understanding of learners' meaning-making processes.

Semi-structured interviews were conducted with each participant after the think-aloud and journal phases. The interviews aimed to explore participants' perceptions of AI translation and paraphrasing tools, including perceived usefulness, limitations, and the rationale behind their stage-specific strategies (Droog et al., 2024). Interview questions also probed participants' reasons for preferring certain platforms (e.g., Google Translate for lexical translation, QuillBot for sentence reformulation, or ChatGPT for broader clarification), allowing the researcher to understand not only how AI was used but also how students navigated choices among multiple available tools. Open-ended questions encouraged students to provide examples and reflect on how AI-mediated support influenced comprehension and engagement. Interviews were audio-recorded with participants' consent and later transcribed verbatim for analysis.

This triangulated approach, combining think-aloud protocols, journals, and interviews, ensured that data reflected both observed behavior and reflective interpretation, strengthening the credibility of the findings. Additionally, the focus on authentic reading tasks preserved ecological validity, as students interacted with academic texts representative of their real learning contexts rather than artificially simplified passages.

Data Analysis

Data analysis followed a thematic, inductive approach informed by the research questions and reading stage framework. All qualitative data, think-aloud transcripts, journal entries, and interview transcripts, were first transcribed and organized chronologically (DeJonckheere et al., 2024), corresponding to the before-, during-, and after-reading stages. This organization facilitated stage-specific coding and comparison across participants.

Initial coding involved identifying passages that reflected students' use of AI translation and paraphrasing tools, including the purposes of use, decision-making processes, and strategies employed. For example, codes captured instances where students used translation to resolve unfamiliar vocabulary, paraphrasing to simplify complex sentences, or a combination of both to check understanding. Cognitive strategies, such as predicting, summarizing, or inferencing, were also coded, as well as affective responses such as confidence, frustration, or reassurance.

Pattern coding was then applied to group initial codes into broader themes representing stage-specific practices and strategies. Themes included "pre-reading comprehension planning," "lexical support during reading," "meaning negotiation with AI tools," and "post-reading consolidation and reflection." Cross-case analysis was conducted to identify common patterns and divergences among participants, highlighting differences in strategy use, tool preferences, and reliance on AI-mediated support.

Analytical memos were written throughout the coding process to document emerging interpretations, connections to reading theories, and considerations of learner agency. Reflexivity was maintained by noting the researcher's assumptions and potential influences on data interpretation, ensuring that findings were grounded in participants' perspectives rather than researcher expectations.

Finally, the thematic findings were synthesized into a stage-specific framework, showing how AI translation and paraphrasing tools were employed before, during, and after reading and how these uses supported meaning-making. This framework allowed the study to provide nuanced, actionable insights into students' strategies and the cognitive and affective roles of AI tools, offering implications for pedagogy and future research on AI-mediated academic reading.

Trustworthiness Procedures

To ensure the credibility and trustworthiness of the analysed data, several validation procedures were employed throughout the analytical process. First, methodological triangulation was established by comparing evidence across three data sources, think-aloud transcripts, reading journals, and semi-structured interviews, so that emerging themes were supported by both observed behavior and participants' reflective accounts rather than relying on a single instrument. Convergences and discrepancies across these sources were carefully examined before finalizing each theme.

Second, peer debriefing and expert validation were conducted during the coding process. An experienced qualitative research colleague with expertise in language education reviewed portions of the coded transcripts, the preliminary coding categories, and the thematic groupings to assess the consistency and interpretive plausibility of the researcher's analysis. Feedback from this review was used to refine overlapping codes, clarify thematic boundaries, and strengthen alignment between raw excerpts and analytical interpretations.

Third, a member-checking procedure was undertaken with a subset of participants after the preliminary themes had been developed. Summaries of the researcher's interpretations regarding students' use of AI translation and paraphrasing tools across the reading stages were shared with six participants, who were invited to confirm whether these interpretations accurately reflected their actual reading experiences and strategic decision-making. Participants generally affirmed the interpretations and provided minor clarifications, which were incorporated into the final thematic framework.

In addition, analytical memos and coding records were maintained as an audit trail to document how interpretations developed from initial coding to final theme construction. These combined procedures enhanced the confirmability, dependability, and credibility of the study's findings by ensuring that the analysis remained grounded in participants' accounts and was subjected to both external review and participant confirmation.

FINDINGS

This section presents the findings of the study according to the two research questions. Data from think-aloud protocols, reading journals, and semi-structured interviews were analysed thematically to capture students' use of AI translation and paraphrasing tools

across the before-reading, during-reading, and after-reading stages, and how these uses supported meaning-making in academic reading. Tables summarize the thematic organization of practices, while excerpts illustrate representative patterns.

Students' Use of AI Translation and Paraphrasing Tools Across Reading Stages

Analysis revealed that students employed AI translation and paraphrasing tools in strategic, stage-specific ways. Table 1 presents the themes and representative examples of these practices.

Table 1.
Stage-Specific Use of AI Translation and Paraphrasing Tools

Reading Stage	Theme	Representative Excerpt
Before-Reading	Previewing Key Terms	*"I first ran the abstract through the translation tool to get a quick idea of difficult words, so I knew what to expect."* (Student 3, Journal)
	Planning Reading Focus	*"By paraphrasing the introduction, I could identify the main argument and focus my reading."* (Student 7, Think-aloud)
During-Reading	Comprehension Monitoring	*"This sentence was long and confusing, so I copied it into the paraphrasing tool; it made the meaning clearer."* (Student 12, Think-aloud)
	Verification of Understanding	*"I paraphrased this paragraph and compared it with the original; it helped me confirm I understood correctly."* (Student 5, Journal)
	Integrating Multiple Tools	*"Sometimes I translated the sentence first, then paraphrased it to make it sound more natural in English."* (Student 9, Think-aloud)
After-Reading	Summarization & Note-Taking	*"After reading, I used the paraphrasing tool to rewrite the main points in my own words for my notes."* (Student 2, Interview)
	Clarifying Ambiguities	*"I went back to sections I didn't fully understand and translated them again to be sure I got the meaning right."* (Student 14, Journal)

During the before-reading stage, students primarily used AI translation to preview text and decode challenging vocabulary, thereby reducing initial uncertainty and setting reading goals. Paraphrasing tools helped participants reframe complex sentences to identify the main argument or central ideas, enabling focused engagement with the text. During the active reading stage, translation tools addressed lexical and syntactic challenges, while paraphrasing tools supported comprehension monitoring and verification. Some students used a combination of translation followed by paraphrasing to ensure that they fully grasped meaning. One participant explained:

> *"Sometimes I translated the sentence first, then paraphrased it to make it sound more natural in English."* (Student 9, Think-aloud)

In the after-reading stage, students engaged in reflective use of AI tools, including summarizing key ideas for note-taking and revisiting difficult passages for clarification. These practices allowed learners to consolidate understanding and ensure comprehension accuracy. As one participant described:

> *"After reading, I used the paraphrasing tool to rewrite the main points in my own words for my notes."* (Student 2, Interview)

Across all stages, students demonstrated self-directed and strategic use of AI tools, emphasizing intentional selection based on the cognitive demands of each reading stage.

How AI Tool Use Supports Meaning-Making in Academic Reading

The second research question focused on how students' AI-mediated practices facilitated understanding, interpretation, and integration of academic texts. Three main functions emerged: lexical support, structural simplification, and reflective consolidation. Table 2 summarizes these functions along with representative excerpts.

Table 2.
Functions of AI Translation and Paraphrasing Tools in Meaning-Making

Function / Theme	Description	Representative Excerpt
Lexical Support	Resolving unfamiliar vocabulary to maintain reading flow	*"I translated difficult words in the methodology section to make sure I wasn't missing important details."* (Student 11, Journal)
Structural Simplification	Rewriting complex sentences or paragraphs for comprehension	*"Paraphrasing helped me break down long sentences and understand the main idea without getting lost."* (Student 6, Think-aloud)
Reflective Consolidation	Summarizing, rephrasing, or revisiting text to deepen understanding	*"After reading, I paraphrased key paragraphs in my notes to check that I truly understood the argument."* (Student 15, Interview)

Lexical support emerged as a core benefit of translation tools. Students reported that immediate access to translations allowed them to overcome vocabulary barriers without interrupting reading flow. One participant noted:

> *"I translated difficult words in the methodology section to make sure I wasn't missing important details."* (Student 11, Journal)

Structural simplification was primarily facilitated by paraphrasing tools. Students used these tools to break down long sentences and dense paragraphs, which reduced cognitive load and promoted clarity. Think-aloud data revealed that students often compared paraphrased output to the original text to confirm understanding:

> *"Paraphrasing helped me break down long sentences and understand the main idea without getting lost."* (Student 6, Think-aloud)

Reflective consolidation occurred after reading, when students used paraphrasing to summarize main points and revisited text segments to clarify ambiguities. This stage enhanced retention, comprehension, and confidence:

> *"After reading, I paraphrased key paragraphs in my notes to check that I truly understood the argument."* (Student 15, Interview)

These stage-specific uses illustrate that AI tools do not function solely as corrective or substitute devices. Instead, they act as cognitive and metacognitive scaffolds, supporting meaning-making and facilitating strategic, self-directed engagement with academic texts.

Analysis indicates a strong relationship between stage-specific practices (RQ1) and meaning-making support (RQ2). For example, before-reading translation supports lexical preparation, during-reading paraphrasing facilitates structural simplification, and after-reading paraphrasing enables reflective consolidation. This integration highlights the dynamic interplay of technology, cognition, and learner agency, showing how AI translation and paraphrasing tools are appropriated to meet both cognitive and affective needs throughout the reading process.

DISCUSSION

This study explored how university students use AI translation and paraphrasing tools during academic reading and how such use supports comprehension and meaning-making across the before-, during-, and after-reading stages. The findings reveal that students' engagement with AI tools is highly strategic, stage-specific, and reflective, highlighting a nuanced interaction between technology, cognition, and learner agency. These results can be discussed through three interconnected lenses: the cognitive and metacognitive processes underlying reading, the sociocultural perspective of digital mediation and translanguaging, and the implications for AI-mediated academic literacy in higher education.

The study underscores the importance of cognitive scaffolding in academic reading. Across all stages, AI translation and paraphrasing tools helped students navigate linguistic challenges that could otherwise impede comprehension. Before reading, translation tools allowed students to decode difficult vocabulary and technical terminology, facilitating comprehension prediction and activation of prior knowledge. This aligns with prior research indicating that pre-reading lexical support reduces cognitive load and enables more efficient processing of complex texts (Hattan, 2024; Lin et al., 2025). By translating key terms and headings, students were able to establish a conceptual framework before engaging with the full text, which supports goal-directed reading and enhances attention to critical ideas (Grabe & Stoller, 2020).

During reading, students demonstrated a dynamic interplay of comprehension monitoring and verification. Paraphrasing tools allowed learners to restructure syntactically dense or semantically complex sentences, enabling them to maintain understanding without interrupting reading flow. Think-aloud protocols revealed that students actively compared AI-generated paraphrases with the original text, reflecting metacognitive awareness and self-regulation. This finding resonates with research emphasizing strategic reading as a process in which learners continuously evaluate comprehension and deploy appropriate resources to resolve breakdowns (Walldén, 2022; Wilson et al., 2024). Importantly, the use of multiple AI tools in combination suggests that students were not passive recipients

of AI output but actively mediated their engagement with technology to manage cognitive load, echoing findings on self-directed and selective AI use in language learning contexts (Murtisari et al., 2024; Rakhmetov et al., 2025).

After reading, students engaged in reflective consolidation, using paraphrasing and translation to summarize key ideas, clarify misunderstandings, and connect information across passages. This post-reading reflection supports meaning integration and longer-term comprehension, illustrating that AI tools can function as metacognitive aids rather than as mechanical substitutes for human processing. Such use aligns with prior studies showing that paraphrasing and reformulation practices support deeper internalization of academic content and facilitate the transition from comprehension to knowledge construction (Mohammad et al., 2023; Thongsan & Anderson, 2025).

Overall, these findings indicate that AI translation and paraphrasing tools scaffold both lower-level and higher-level cognitive processes, from decoding vocabulary to restructuring complex sentences and synthesizing information. By supporting cognitive processing at multiple levels, AI tools extend learners' capacity to engage with academically challenging texts, highlighting their potential as adaptive cognitive resources within digital reading environments (Feng, 2025; Shafiee Rad, 2025).

The study also provides insight into the sociocultural dimensions of AI-mediated reading. Drawing on sociocultural perspectives, AI tools can be conceptualized as mediational artifacts that extend learners' capacity to perform reading tasks beyond what they might achieve independently (Poehner & Lu, 2024). Translation tools served as scaffolds that enabled lexical and semantic comprehension, while paraphrasing tools facilitated syntactic and conceptual reorganization. The active and reflective use of these tools illustrates that they are appropriated by students as cultural artifacts embedded in academic literacy practices, mediating meaning-making rather than dictating it (Silvola et al., 2025; Ou et al., 2024).

The findings also intersect with translanguaging theory, which emphasizes learners' flexible use of multiple linguistic resources to construct meaning (Qureshi & Al-Surmi, 2025). Students often alternated between L1 and L2 through AI translation and then relied on paraphrasing tools in English to refine understanding, reflecting deliberate cross-linguistic strategies. This pattern suggests that AI tools extend rather than replace learners' translanguaging practices, enabling more efficient negotiation of complex academic texts (Waluyo & Rouaghe, 2025; Kruk & Kałużna, 2025). Such strategic cross-linguistic use highlights how AI technologies can support bilingual cognitive scaffolding and meaning-making.

Furthermore, AI tools were appropriated in ways that reflect learner agency. Participants chose when and how to engage with translation or paraphrasing based on task difficulty, prior knowledge, and confidence in comprehension. This reinforces research emphasizing that the pedagogical value of AI lies not in the tools themselves but in learners' metacognitive awareness and decision-making processes (Delcker et al., 2024; Kim et al., 2025). In this sense, AI tools function as facilitators of self-directed learning rather than deterministic solutions, underscoring the importance of instructional approaches that cultivate strategic and reflective AI use.

The study contributes to understanding how AI technologies can support academic reading in higher education in several ways. First, it highlights the importance of stage-

specific interventions, as AI tools offer different affordances depending on whether learners are preparing to read, actively engaging with texts, or reflecting after reading (Grabe & Stoller, 2020). Recognizing these stage-specific uses can inform instructional practices, such as encouraging pre-reading vocabulary exploration through translation, comprehension monitoring through paraphrasing during reading, and post-reading consolidation through summarization.

Second, the findings suggest that the combined use of translation and paraphrasing tools enhances reading efficiency and comprehension quality. By integrating multiple AI tools, students were able to address both lexical and syntactic challenges, supporting sustained engagement with complex academic texts. This finding aligns with research on integrated AI-supported literacy practices that emphasize strategic tool orchestration rather than isolated tool use (Suhardiman et al., 2025; Nguyen et al., 2024).

Third, AI-mediated reading practices appear to reduce cognitive and affective barriers. Students reported that AI support lowered anxiety, facilitated persistence when encountering dense texts, and increased confidence in comprehension. This affective dimension is particularly important in academic reading, where linguistic difficulty often undermines motivation and engagement (Derakhshan et al., 2025; Zhai & Nezakatgoo, 2025). By supporting both cognitive and emotional aspects of reading, AI tools contribute to a more holistic development of academic literacy.

Finally, the findings underscore that AI technologies should be viewed as extensions of existing literacy practices rather than replacements for fundamental reading skills. Effective use requires metacognitive awareness, critical evaluation of AI output, and active integration of tool-mediated insights into meaning-making processes (Rakhmetov et al., 2025; Thongsan & Anderson, 2025). Instructional frameworks and digital literacy initiatives should therefore emphasize strategic AI use to ensure that learners develop both strong reading competence and responsible engagement with emerging technologies.

In sum, the discussion demonstrates that AI translation and paraphrasing tools operate as cognitively and socially mediating artifacts that support students' strategic and reflective engagement with academic texts. By providing lexical scaffolding, structural simplification, and reflective consolidation, these tools enhance comprehension, promote learner agency, and extend translanguaging practices in academic reading. The findings reinforce the view that AI can meaningfully support academic literacy when embedded thoughtfully within pedagogical contexts and when learners are empowered to exercise metacognitive control over their reading processes.

CONCLUSION

This study investigated how university students use AI translation and paraphrasing tools during academic reading and how these tools support comprehension across the before-, during-, and after-reading stages. The findings indicate that students engage with AI tools in a strategic, stage-specific, and reflective manner, leveraging translation for lexical support, paraphrasing for structural simplification, and both tools for reflective consolidation. These practices reveal that AI technologies function as both cognitive and metacognitive scaffolds, facilitating meaning-making, reducing cognitive load, and enhancing learners' confidence when navigating complex academic texts. Importantly, students' active and deliberate use of AI demonstrates a high degree of learner agency,

emphasizing that technology is most effective when integrated thoughtfully into learners' self-directed reading practices rather than used passively.

The study has several implications for research and practice. Pedagogically, instructors can encourage students to adopt stage-specific strategies when engaging with AI tools, such as using translation for pre-reading vocabulary preparation, paraphrasing for comprehension monitoring during reading, and summarizing or revisiting passages after reading to consolidate understanding. The findings also suggest the potential for training programs that develop learners' metacognitive awareness and strategic AI use, ensuring that technology enhances rather than replaces fundamental reading skills. For future research, longitudinal studies could examine how sustained AI-mediated reading practices impact comprehension, academic writing, and disciplinary literacy over time. Additionally, comparative studies could explore differences in tool use and effectiveness across proficiency levels, disciplines, or cultural contexts, further illuminating how AI technologies can support inclusive and adaptive academic literacy development in diverse higher education settings.

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