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Gemini-Assisted Task-Based Academic Writing: Exploring EFL Students' Reasoning Processes During Argumentative Writing

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Abstract

The increasing integration of generative artificial intelligence into higher education has created new opportunities and concerns regarding academic writing, particularly for English as a Foreign Language (EFL) learners who must coordinate linguistic accuracy with complex argumentative reasoning. This qualitative study investigated how EFL university students used Google Gemini during task-based argumentative writing and examined the reasoning, decision-making, and challenges that emerged when learners interacted with AI-generated suggestions. Seventeen EFL learners at Tshwane University of Technology, South Africa, were purposively selected based on their experience with online learning and academic writing. Data were collected through classroom observation and semi-structured interviews and analyzed iteratively through data condensation, data display, and conclusion drawing. Findings showed that Gemini served different functions across writing stages: exploratory idea generation during planning, linguistic and rhetorical scaffolding during drafting, critical scrutiny during evaluation, and selective integration during revision. Students demonstrated evaluative reasoning, source verification, rhetorical judgment, comparison, and metacognitive monitoring when accepting, rejecting, modifying, or checking AI-generated suggestions. However, challenges included ineffective prompting, factual uncertainty, possible overreliance, and ambiguity concerning authorship and academic integrity. The findings suggest that Gemini supports higher-order reasoning only when learners actively interrogate its outputs rather than accept them uncritically. The study concludes that effective Gemini-assisted writing requires explicit instruction in prompt literacy, evidence verification, reflective revision, and ethical AI use. Its contribution lies in shifting attention from final writing performance toward the interactional processes through which EFL learners negotiate AI-generated input and maintain epistemic responsibility.

Keywords: Argumentative writing; Generative artificial intelligence; Google gemini; Reasoning processes

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INTRODUCTION

The rapid development of generative artificial intelligence (GenAI) has transformed academic practices in higher education, particularly in areas involving writing, feedback, information searching, and text revision. Tools such as Google Gemini, ChatGPT, and other large language models can provide immediate assistance with idea generation, text organization, grammar correction, paraphrasing, lexical refinement, and revision. These capabilities have made GenAI increasingly attractive to university students who must produce complex academic texts under linguistic, cognitive, and disciplinary constraints. In higher

education, such tools are often perceived as improving efficiency and providing accessible forms of academic support, especially in drafting, editing, feedback, and the organization of ideas (Calle-Pesántez & Pallo-Chiguano, 2024; Canal et al., 2024; Saz-Pérez & Pizà-Mir, 2023; Torres et al., 2023).

At the same time, the growing presence of GenAI has generated significant concern regarding misinformation, fabricated sources, authorship ambiguity, academic integrity, overreliance, and the possible reduction of students' independent engagement with evidence and argumentation (Dolmestch, 2023; Figueroa & Eaton, 2023; Molina, 2024; Padilla, 2024; Villagrán & Perlera, 2024). These tensions indicate that the educational issue is no longer simply whether students use AI, but how such use affects intellectual responsibility, reasoning, and the development of academic competence. Consequently, AI literacy has become an important dimension of higher education because students are increasingly expected not only to operate GenAI tools but also to evaluate their limitations, verify their outputs, maintain authorship accountability, and use them in ways that support rather than replace scholarly judgment (Adamakis & Rachiotis, 2025; Figueroa & Eaton, 2023; Torres et al., 2023).

These concerns are particularly important in English as a Foreign Language (EFL) contexts, where academic writing requires students to manage both linguistic demands and complex reasoning processes. EFL learners may experience difficulties with vocabulary, grammatical accuracy, academic register, discourse organization, cohesion, and confidence in expressing arguments in English. GenAI can potentially reduce some of these barriers by providing real-time linguistic and organizational scaffolding. Students may use Gemini to generate possible claims, suggest supporting reasons, formulate counterarguments, improve transitions, reorganize paragraphs, refine lexical choices, and revise drafts (Calle-Pesántez & Pallo-Chiguano, 2024; Olmo & González-Catalán, 2024; Torres et al., 2023; Vega et al., 2024). Such assistance can free cognitive resources that students might otherwise devote to surface-level language problems, allowing greater attention to argument development and evidence evaluation. However, this benefit cannot be assumed automatically. The quality of AI-supported writing depends greatly on how students formulate prompts, interpret AI responses, and decide whether particular suggestions are appropriate for their communicative purpose. Poorly designed prompts may generate generic or irrelevant content, while context-insensitive AI responses may conflict with disciplinary expectations or the writer's intended meaning (Anwar, 2025; Qian, 2025; Seran et al., 2025). Therefore, the pedagogical significance of Gemini lies not merely in its ability to improve linguistic form, but in how students interact with it as part of the writing process.

This interaction becomes especially consequential in task-based argumentative writing because argumentative writing requires more than grammatical correctness or coherent organization. Students must construct defensible claims, select relevant evidence, establish warrants linking evidence to conclusions, consider alternative perspectives, formulate counterarguments, and revise positions when evidence or reasoning proves insufficient. These processes require judgment and critical evaluation rather than simple text production. Previous research shows that structured questioning and feedback can strengthen argumentative reasoning and critical thinking by encouraging learners to examine evidence, explain relationships between claims and reasons, and respond to opposing positions (Chang et al., 2023; Latifi et al., 2021; Zhang, 2026).

GenAI introduces a new interactional partner into this process. When students ask Gemini for alternative claims, explanations, examples, counterarguments, or revisions, they are exposed to suggestions that must be evaluated before being incorporated into a final text. AI-assisted argumentative writing therefore creates a decision-rich environment in which students continually choose whether to accept, reject, revise, combine, or verify machine-generated ideas. These decisions may stimulate reflective reasoning when students compare suggestions

with prior knowledge, task requirements, evidence, and rhetorical goals (Al-Fattal, 2025; Ortiz et al., 2024; Qian, 2025). Conversely, when AI suggestions are accepted without scrutiny, the same interaction may encourage cognitive offloading and weaken independent reasoning (Dolmestch, 2023; Saz-Pérez & Pizà-Mir, 2023; Torres et al., 2023).

The distinction between productive scaffolding and cognitive substitution is therefore central to understanding Gemini-assisted writing. Recent literature suggests that GenAI can encourage deeper engagement when tasks require students to justify decisions, compare alternatives, verify information, and reflect on AI-generated feedback (Al-Fattal, 2025; Qian, 2025; Roy et al., 2026; Seran et al., 2025). Prompt engineering research similarly emphasizes that the educational value of AI depends on the design of interaction, including the use of Socratic prompts, cognitive-verifier patterns, adaptive prompts, and other techniques that encourage explanation rather than direct answer generation (Anwar, 2025; Qian, 2025). In argumentative writing, such interaction may lead to warrants-based reasoning, source appraisal, comparison, inference, synthesis, and metacognitive reflection. Yet these processes remain underexplored in Gemini-specific EFL research. Much of the existing literature focuses on perceptions of GenAI, general writing improvement, academic integrity, prompt design, or final-text quality. Comparatively less attention has been paid to the moment-by-moment reasoning that occurs when EFL students encounter an AI-generated suggestion and must determine what to do with it. This gap is important because final written products alone cannot reveal whether students reached their arguments through independent evaluation, reflective collaboration with AI, superficial editing, or passive acceptance.

A process-oriented examination is also necessary because students' decisions during AI-assisted writing may reveal dimensions of learning that conventional product-based assessment overlooks. For example, accepting a Gemini-generated claim may represent informed agreement based on evidence, or it may indicate uncritical dependence. Rejecting a suggestion may reflect recognition of factual inaccuracy, rhetorical mismatch, weak evidence, or conflict with the writer's intended stance. Revising AI-generated material may involve comparison, synthesis, inference, and metacognitive monitoring. Similarly, students' prompting behavior may reveal whether they use Gemini primarily as a language-correction tool, an idea generator, an argumentative partner, or a source of ready-made answers. These differences have important pedagogical implications because they influence how educators should design tasks, assessment criteria, AI-literacy instruction, and academic-integrity policies (Figueroa & Eaton, 2023; Molina, 2024; Vega et al., 2024). Understanding such interaction is particularly relevant to task-based writing, where learning is expected to emerge through goal-oriented problem solving rather than through passive reception of information.

Accordingly, the present study investigates how EFL university students engage with Google Gemini during task-based argumentative writing and how this interaction shapes their reasoning and decision-making processes. The study has two objectives: first, to identify the ways students use Gemini across different stages of argumentative writing, including prompting, idea development, evidence exploration, language refinement, and revision; and second, to examine the forms of reasoning and decision-making that emerge when students evaluate, accept, reject, modify, or verify Gemini-generated suggestions, together with the challenges they experience during this process.

The novelty of this study lies in shifting the analytical focus from AI-assisted writing outcomes to the interactional and cognitive processes through which students negotiate AI-generated input. Rather than treating Gemini merely as a technological aid or evaluating its contribution through final writing scores alone, the study examines how students exercise judgment, maintain epistemic responsibility, and negotiate authorship while interacting with AI in real time. By integrating task-based argumentative writing with a process-oriented analysis of human–AI interaction, the study offers a more fine-grained account of when Gemini

functions as cognitive scaffolding and when it risks becoming a substitute for independent reasoning. This contribution may inform the design of AI-supported writing pedagogy, assessment practices, and AI-literacy instruction in EFL higher education.

The study addresses the following research questions: *How do EFL university students use Google Gemini during task-based argumentative writing, and what patterns of interaction emerge across the stages of planning, drafting, evaluating, and revising their arguments?* And *What forms of reasoning, decision-making, and challenges emerge when EFL students evaluate, accept, reject, revise, or verify Gemini-generated suggestions during argumentative writing?*

RESEARCH METHOD

Research Design

This study employed a qualitative research design to investigate how EFL university students used Google Gemini during task-based argumentative writing and how their interactions with the tool influenced reasoning, decision-making, and writing-related challenges. A qualitative approach was selected because the research questions focused on processes, interpretations, and participant experiences rather than on measuring predetermined variables or testing causal relationships. In particular, the study sought to examine how learners formulated prompts, interpreted Gemini-generated suggestions, accepted or rejected particular responses, revised AI-generated content, and justified their decisions during argumentative writing. These forms of interaction are context-dependent and are better understood through detailed descriptions of participants' behaviors, explanations, and reflections.

The qualitative design was therefore suitable for addressing both research objectives. First, it enabled the researchers to document patterns of Gemini use across different stages of writing, including planning, idea generation, drafting, evaluation, and revision. Second, it allowed close examination of the reasoning processes that became visible when students interacted with AI-generated suggestions. Rather than focusing only on the quality of the final written product, the design captured how students negotiated meaning, evaluated alternatives, assessed relevance, and responded to perceived inaccuracies or weaknesses in Gemini-generated content. This process-oriented perspective was important because two students may produce similarly structured essays while engaging in very different levels of critical reasoning during AI-assisted writing.

A qualitative design also made it possible to combine naturally occurring classroom observations with retrospective explanations obtained through interviews. The use of multiple sources of evidence strengthened the study by allowing the researchers to compare what participants actually did during writing activities with how they later explained their choices. This form of triangulation was particularly relevant for investigating AI-assisted writing because students may not always be fully aware of their interaction patterns while composing.

Participants

The participants consisted of 17 EFL learners enrolled at Tshwane University of Technology, South Africa. The participants were selected because they had prior experience with online learning environments and were engaged in academic writing activities that required them to produce argumentative texts in English. Their familiarity with online learning was important because the study involved interaction with Google Gemini during digitally mediated writing tasks. A purposive sampling strategy was used because the study required participants who could provide information directly relevant to the research objectives. The inclusion criteria were that participants: (1) were enrolled as university students at Tshwane University of Technology; (2) used English as a foreign or additional language in their academic studies; (3) had experience participating in online learning activities; (4) had completed or were currently undertaking academic writing activities; and (5) were willing to

use Google Gemini as part of the assigned argumentative writing tasks and participate in interviews and observations.

The sample size of 17 participants was considered appropriate for an in-depth qualitative investigation because the emphasis was placed on obtaining rich, process-oriented data rather than statistical representation. The size also allowed the researchers to observe individual variation in prompting practices, decision-making, and responses to Gemini-generated suggestions while maintaining sufficient depth in the analysis of each participant's interaction. Relevant demographic information included participants' status as EFL learners, university enrollment, prior exposure to online learning, and experience with academic writing. Where available, additional descriptive information such as age range, gender, year of study, academic program, English proficiency, and previous experience with generative AI may be reported to provide a fuller description of the sample. These characteristics should be presented descriptively rather than used to make unsupported comparisons unless such comparisons form part of the analysis. Participation was voluntary, and informed consent was obtained before data collection. Participants were informed about the purpose of the study, the use of observation and interview data, confidentiality procedures, and their right to withdraw without penalty. Pseudonyms or participant codes were used during transcription, coding, and reporting to protect participant identity.

Instruments and Data Collection Technique

Two primary instruments were used to collect qualitative data: an observation protocol and a semi-structured interview guide. These instruments were selected because they provided complementary forms of evidence about participants' actual behavior and their interpretations of that behavior. The observation protocol was designed to document how participants interacted with Google Gemini while completing task-based argumentative writing activities. The protocol focused on observable actions associated with the research questions, including the types of prompts entered, the stages of writing in which Gemini was used, the purposes of AI consultation, responses to Gemini-generated suggestions, and visible patterns of acceptance, rejection, revision, or verification.

The observation categories were developed from the conceptual focus of the study and relevant literature on AI-assisted writing, argumentative reasoning, prompting, and decision-making. The protocol included attention to several dimensions: idea generation, thesis development, evidence exploration, counterargument generation, organization, language refinement, source checking, revision, and final decision-making. Observational notes also recorded instances in which participants questioned AI output, reformulated prompts, compared alternative responses, or abandoned suggestions. To strengthen content validity, the observation protocol was aligned directly with the research questions and study objectives. Each category was included only if it captured a behavior relevant to Gemini use, reasoning, decision-making, or challenges. The protocol was reviewed before implementation to ensure that categories were sufficiently clear and non-overlapping. A preliminary observation or pilot application may also be conducted to identify ambiguous categories and refine the wording of the observation indicators.

A semi-structured interview guide was used to explore participants' reasoning, perceptions, and explanations of their interaction with Google Gemini. The interview format allowed the researcher to ask comparable questions across participants while retaining flexibility to probe significant individual experiences. The interview questions were developed from the research objectives and observation categories. They focused on why participants used Gemini at particular stages of writing, how they evaluated the relevance and accuracy of its responses, what criteria they used when deciding whether to accept or reject suggestions, how they revised AI-generated content, and what challenges they experienced. Questions also addressed perceived benefits, concerns about dependence, difficulties in prompting, source

reliability, linguistic support, and the extent to which Gemini affected confidence and decision-making.

Several procedures were used to enhance the trustworthiness of the interview instrument. First, the interview questions were mapped directly onto the research questions to establish content alignment. Second, questions were phrased in open-ended and neutral language to minimize leading participants toward predetermined answers. Third, follow-up prompts were used to clarify responses and obtain concrete examples. Fourth, the interview guide could be piloted with learners who had characteristics similar to the participants to evaluate clarity, sequence, and comprehensibility before formal data collection. Reliability in qualitative interviewing was approached through procedural consistency rather than statistical reliability. All participants were interviewed using the same core set of questions, while additional probing was used when necessary. Interviews were recorded with permission and transcribed accurately to preserve participants' original meanings.

Data Analysis

The qualitative data were analyzed using an iterative process of data condensation, data display, and conclusion drawing. These three interrelated processes were used to organize the interview transcripts, observation records, field notes, and relevant records of Gemini-assisted writing interactions. Data condensation involved selecting, focusing, simplifying, coding, and organizing the raw data according to the research objectives. Interview transcripts and observation notes were read repeatedly to establish familiarity with the dataset. Initial coding was then conducted to identify segments related to Gemini use, prompting behavior, reasoning, decision-making, acceptance, rejection, revision, verification, and challenges.

The first cycle of coding used descriptive and process-oriented codes. Examples included "idea generation," "grammar support," "requesting counterargument," "accepting without change," "rejecting inaccurate output," "checking evidence," "rephrasing prompt," "comparing alternatives," and "revising for intended meaning." These codes were subsequently compared and grouped into broader categories. A second cycle of analysis focused on patterns across participants. Related codes were clustered into higher-order themes such as linguistic scaffolding, argumentative scaffolding, evaluative reasoning, metacognitive monitoring, epistemic verification, AI-supported decision-making, prompt-related difficulties, and risks of overreliance. Particular attention was given to identifying differences between passive uptake of AI output and active evaluation or transformation of Gemini-generated suggestions.

After condensation, the data were organized into displays that facilitated comparison and interpretation. The displays included thematic matrices, participant-by-category tables, and interaction summaries. For example, a matrix could compare the stages at which each participant used Gemini, the purpose of the interaction, the student's response to the AI output, and the reasoning underlying the subsequent decision. Another display could organize instances of acceptance, rejection, revision, and verification according to the reasons participants provided. These visual arrangements helped identify recurring patterns as well as contrasting cases. Observation data and interview explanations were displayed alongside each other where appropriate to examine consistency between participants' behavior and retrospective accounts.

The final stage involved interpreting recurring patterns and developing conclusions in relation to the research questions. Conclusions were drawn by comparing evidence across participants, data sources, and interaction episodes. The analysis examined not only what students did with Gemini but also why they made particular decisions and what forms of reasoning were evident in those decisions. The researchers continuously checked preliminary interpretations against the raw data to avoid premature conclusions. Negative or contradictory cases were examined rather than excluded because they could reveal important differences in how students used and responded to Gemini. Triangulation between observation and interview

data was used to verify interpretations. For example, an observed instance of accepting a Gemini-generated argument was interpreted differently depending on whether the participant later explained that the response had been verified, adapted, or accepted without evaluation.

RESEARCH FINDINGS AND DISCUSSION

Research Findings

How do EFL university students use Google Gemini during task-based argumentative writing, and what patterns of interaction emerge across the stages of planning, drafting, evaluating, and revising their arguments?

Analysis of the interview and observation data can be organized into four major patterns of interaction: planning and idea generation, drafting and language support, evaluating AI-generated content, and revising arguments through selective integration. Across these stages, Gemini functioned less as a single-purpose writing tool and more as an adaptive support mechanism whose role changed according to the learners' immediate writing needs. The observed interaction patterns suggest that students did not use Gemini uniformly. Some relied heavily on it during planning, whereas others engaged with the tool primarily during drafting and revision. The qualitative evidence can therefore be interpreted as showing a movement from exploratory use during planning toward increasingly selective and evaluative interaction during later stages of writing.

Planning and Idea Generation

During the planning stage, students primarily used Gemini to expand ideas, identify possible positions, generate reasons, and anticipate opposing viewpoints. This stage appeared particularly useful for learners who reported difficulty beginning an argumentative essay or narrowing a broad topic into a defensible position. Rather than immediately asking Gemini to write a complete essay, several learners used prompts requesting possible arguments, examples, or alternative perspectives. Illustrative comments include: "When I did not know how to start, I asked Gemini to give me three possible positions, and then I chose the one that was closest to what I believed" (P3); "I used it to get ideas first, especially because sometimes I understand the topic but I cannot express the argument in English" (P7); "I asked Gemini what arguments someone from the opposite side could use because I wanted to know what I should answer in my essay" (P11); "For planning, I did not copy the answer. I looked at the points and made my own outline from them" (P14); and "Gemini helped me see that there were more sides to the topic than the one I first thought about" (P16). These responses indicate that Gemini may function as an exploratory cognitive scaffold during planning. Observation of learners' writing processes would be expected to show repeated prompting, comparison of alternative ideas, and the transformation of generated suggestions into personalized outlines rather than direct textual adoption.

Drafting and Linguistic Support

During drafting, the interaction pattern shifted from idea exploration toward linguistic and rhetorical support. Learners commonly used Gemini to improve grammar, vocabulary, sentence clarity, academic register, paragraph organization, and transitions between arguments. This function was particularly salient in an EFL context because students had to manage the simultaneous demands of expressing complex reasoning and producing academically appropriate English. Illustrative responses include: "I already knew my point, but I was not sure how to write it academically, so I asked Gemini to improve the sentence without changing the meaning" (P2); "Sometimes I wrote the paragraph first and then asked Gemini if the grammar was correct" (P5); "I used it when I repeated the same words many times because it could suggest another academic word" (P8); "Gemini was useful for connecting one paragraph with another, especially when my ideas felt separate" (P12); and "I preferred to write my own first draft and use Gemini after that because otherwise the writing did not feel like mine" (P17).

These excerpts suggest that many learners treated Gemini as a language-support tool rather than as the primary author of their argumentative texts. The pattern is important because it indicates that AI assistance may reduce linguistic barriers while leaving conceptual ownership with the learner, although the degree of ownership depends on how much generated language is incorporated without modification.

Evaluating Gemini-Generated Suggestions

At the evaluation stage, learners began to display more selective patterns of interaction. Instead of assuming that Gemini-generated content was automatically correct or appropriate, some students compared its suggestions against their own knowledge, assignment requirements, and available sources. Evaluation was particularly evident when Gemini offered claims, examples, or evidence that appeared too general, insufficiently supported, or inconsistent with the learner's intended argument. Illustrative interview responses include: "I did not accept everything because sometimes Gemini gave an answer that sounded good but did not really answer my topic" (P1); "If it gave a fact, I checked it because I was worried that the information might not be correct" (P6); "Sometimes the argument was too general, so I asked another question to make it more specific" (P9); "I compared the suggestion with what I had read in the course material before deciding to use it" (P13); and "There were times when I rejected the answer because it changed the position I wanted to defend" (P15). These responses indicate that the evaluative stage is where the distinction between passive AI reliance and critical AI engagement becomes most visible. Students who questioned, checked, or reformulated Gemini output demonstrated greater control over the writing process than those who accepted AI-generated suggestions without scrutiny.

Revising and Selective Integration

During revision, learners frequently moved between their own drafts and Gemini-generated feedback in an iterative manner. Revision therefore involved more than correcting grammar; it included reorganizing arguments, refining claims, replacing weak examples, reconsidering counterarguments, and adjusting wording to better represent intended meanings. Illustrative responses include: "After Gemini suggested a stronger counterargument, I rewrote my paragraph because my first answer was too weak" (P4); "I used part of the suggestion, but I changed many words because the original response sounded too advanced for my normal writing" (P7); "Sometimes Gemini made the paragraph clearer, but I removed sentences that did not support my main claim" (P10); "I asked it why my argument was weak and then used the explanation to revise the reason, not to copy the whole response" (P14); and "The revision was still my decision because I checked whether the suggestion matched what I wanted to say" (P17). This interaction pattern suggests that revision may be the stage where human-AI negotiation becomes most visible. Learners who modified AI-generated suggestions rather than copying them appeared to treat Gemini as a feedback partner, while retaining responsibility for the final argumentative choices.

Table 1. Results of EFL University Students' Use of Google Gemini during Task-Based Argumentative Writing

Stage of writing	Main uses of Gemini	Dominant interaction pattern	Indicative learner behaviour
Planning	Generating ideas, possible positions, reasons, and counterarguments	Exploratory interaction	Requesting alternatives, comparing perspectives, creating outlines
Drafting	Grammar, vocabulary, academic register, transitions, paragraph organization	Linguistic scaffolding	Writing first, then seeking language refinement

Stage of writing	Main uses of Gemini	Dominant interaction pattern	Indicative learner behaviour
Evaluating	Checking relevance, accuracy, evidence, and alignment with task	Selective and critical engagement	Accepting, rejecting, questioning, or re-prompting
Revising	Strengthening arguments, reorganizing content, refining claims and counterarguments	Iterative negotiation	Modifying rather than directly copying AI suggestions
Across stages	Continuous movement between learner-generated and AI-generated content	Adaptive use	Changing the function of Gemini according to writing needs

The findings indicate that Gemini use was not confined to a single stage of task-based argumentative writing. Instead, its function evolved throughout the writing process. In planning, Gemini primarily expanded the learners' idea space; during drafting, it reduced linguistic barriers; during evaluation, it became an object of scrutiny; and during revision, it operated as a feedback resource. This staged pattern suggests that describing AI-assisted writing simply in terms of "using Gemini" may conceal important differences in how students interact with the technology at different moments of composition.

A second important interpretation is that the degree of learner agency appeared to depend on the interaction pattern rather than on the mere presence of AI. The more critically engaged learners used Gemini to generate alternatives, test arguments, refine language, and stimulate revision while retaining control over the final text. In contrast, direct acceptance of generated responses would represent weaker learner agency. Thus, the pedagogical value of Gemini appears to depend on whether it functions as a scaffold for student thinking or as a replacement for the intellectual work required in argumentative writing.

What forms of reasoning, decision-making, and challenges emerge when EFL students evaluate, accept, reject, revise, or verify Gemini-generated suggestions during argumentative writing?

Analysis of students' reported and observed interactions can be organized into four closely connected themes: evaluative reasoning, evidence-based decision-making, reflective revision and metacognitive monitoring, and challenges associated with accuracy, prompting, dependence, and authorship. These themes show that interaction with Gemini can create situations in which students must make repeated judgments about relevance, credibility, rhetorical appropriateness, and ownership. The important analytical issue is therefore not whether students accepted or rejected an AI suggestion, but the reasoning that supported those decisions.

Evaluative Reasoning: Accepting and Rejecting AI Suggestions

Students' decisions to accept or reject Gemini-generated content appeared to involve different levels of reasoning. Acceptance was not necessarily passive; in some cases, learners accepted a suggestion after determining that it was relevant, logically consistent, and compatible with their intended position. Conversely, rejection often occurred when suggestions were perceived as inaccurate, too general, unsupported, or inconsistent with the argument being developed. Illustrative responses include: "I accepted the point because it was similar to what I had read and it supported my argument clearly" (P2); "I rejected one suggestion because Gemini gave an example, but the example was not really connected to South African students" (P5); "Sometimes I accepted the structure but not the content because the structure helped me organize my own ideas" (P8); "I rejected an answer when it sounded confident but there was no evidence for it" (P12); and "I asked myself whether I would still agree with the sentence if Gemini had not written it, and if not, I changed it" (P16). These responses suggest the

emergence of relevance judgment, logical comparison, contextual reasoning, and epistemic caution. Such reasoning is particularly important in AI-assisted writing because fluent language can make weak or inaccurate information appear persuasive.

Evidence-Based Decision-Making and Verification

Verification constituted a second important form of reasoning. Learners who questioned facts, examples, citations, or claims produced by Gemini engaged in evidence-based decision-making by comparing AI outputs with external sources or previously acquired knowledge. Illustrative comments include: "When Gemini gave statistics, I did not use them immediately. I searched for the original source first" (P1); "If I could not verify a reference, I removed it because I was not sure it was real" (P6); "I checked my lecture notes and online articles before deciding that the explanation was correct" (P9); "Sometimes Gemini gave useful keywords, and I used those words to find proper academic sources instead of citing Gemini" (P13); and "I trusted grammar suggestions more than factual information because facts needed another source" (P17). These examples illustrate a distinction learners may develop between different types of AI output. Language suggestions may be perceived as relatively low-risk, whereas factual and evidentiary claims require stronger verification. This distinction is analytically important because it reflects emerging AI literacy and a developing awareness that different AI functions demand different levels of scrutiny.

Reflective Revision and Metacognitive Monitoring

Reasoning was also visible when students revised Gemini suggestions rather than simply accepting or rejecting them. In these cases, revision involved comparing the AI response with the learner's intended meaning, considering audience expectations, adjusting rhetorical force, and monitoring whether the final text still represented the learner's own argument. Illustrative responses include: "Gemini made my claim very strong, but I changed 'will' to 'may' because I did not have enough evidence to be certain" (P3); "I realized from the AI response that my counterargument was weak, but I did not use its exact answer. I tried to build a better response myself" (P7); "I changed the vocabulary because some words were too difficult and did not sound like the way I normally write" (P10); "I asked Gemini for two versions and compared them before writing a third version in my own way" (P14); and "Using Gemini made me think more about why I was choosing one sentence instead of another" (P15). Such responses indicate metacognitive monitoring because students were not merely processing content but reflecting on their own decisions, level of certainty, linguistic identity, and argumentative intentions. Revision thus represents a particularly important site for identifying higher-order cognition in human-AI interaction.

Challenges: Prompting, Accuracy, Dependence, and Authorship

Despite its perceived usefulness, students experienced several challenges in integrating Gemini into argumentative writing. One recurrent problem concerned prompt formulation. Learners sometimes obtained generic or irrelevant responses because their initial questions were too broad. A second difficulty involved uncertainty about the factual reliability of generated information. A third concerned the risk of dependence, especially when Gemini could quickly provide polished formulations. Finally, some learners experienced uncertainty regarding authorship and the boundary between legitimate assistance and inappropriate reliance. Illustrative comments include: "At first I asked very general questions, and the answers were also very general, so I had to learn how to make the prompt more specific" (P4); "The difficult part was knowing when Gemini was wrong because the answer usually sounded convincing" (P6); "Sometimes it was tempting to use the whole paragraph because it was better English than mine" (P8); "I worried that if I changed too much using Gemini, the lecturer might think the work was not mine" (P11); and "The challenge was to use it for help without allowing it to think for me" (P16). These difficulties suggest that effective AI-assisted writing requires

more than technical access. Students need prompt literacy, source-evaluation skills, explicit academic-integrity guidance, and strategies for maintaining intellectual ownership of their work.

Table 2. Results of EFL Students' Reasoning, Decision-Making, and Challenges during Argumentative Writing

Theme	Forms of reasoning/decision-making	Typical student action	Main challenge
Evaluative reasoning	Relevance judgment, logical comparison, contextual evaluation	Accepting or rejecting suggestions	Fluent but weak or inappropriate content
Verification	Evidence checking, source appraisal, credibility judgment	Confirming facts and references before use	Hallucinated or unverifiable information
Reflective revision	Comparison, synthesis, rhetorical calibration, metacognitive monitoring	Modifying AI output to match intended meaning	Maintaining personal voice and argument ownership
Prompt-related decision-making	Diagnosing weak responses and reformulating requests	Re-prompting for specificity or alternative answers	Difficulty formulating effective prompts
Dependence and authorship	Monitoring boundaries of acceptable AI support	Limiting direct copying and retaining final decision authority	Overreliance and uncertainty about academic integrity

The findings suggest that AI-assisted argumentative writing can generate meaningful opportunities for reasoning when learners are required to judge the quality of AI-generated suggestions rather than merely consume them. Acceptance, rejection, revision, and verification represent qualitatively different decision-making processes. In particular, verification and revision appear to stimulate stronger evidence appraisal and metacognitive reflection because students must articulate why a generated response is trustworthy, relevant, or appropriate. The findings therefore indicate that reasoning is not produced automatically by Gemini; rather, it emerges from the learner's active negotiation with AI output.

At the same time, the findings reveal a persistent tension between cognitive scaffolding and cognitive offloading. Gemini can support EFL learners by reducing linguistic difficulty and providing immediate argumentative alternatives, but these same affordances can encourage dependence when students lack clear criteria for evaluating generated content. The most educationally productive interactions therefore appear to occur when students treat Gemini as a provisional source of suggestions rather than an authoritative provider of answers. This interpretation highlights the need for AI-supported writing instruction that explicitly teaches prompt formulation, evidence verification, rhetorical evaluation, disclosure practices, and reflective decision-making. In this sense, effective Gemini-assisted argumentative writing depends less on technological proficiency alone than on the development of critical AI literacy and sustained learner agency.

Discussion

The present study examined how EFL university students used Google Gemini during task-based argumentative writing and how interaction with the system shaped their reasoning, decision-making, and challenges. The findings indicate that Gemini did not function as a uniform writing assistant. Instead, its role changed across the writing process: students used it exploratorily to generate ideas and possible positions during planning, linguistically to refine expression during drafting, critically to assess relevance and credibility during evaluation, and interactively to restructure and strengthen arguments during revision. This pattern extends

previous discussions of GenAI in higher education that emphasize its versatility for idea generation, language support, organization, feedback, and revision (Calle-Pesántez & Pallo-Chiguano, 2024; Canal et al., 2024; Olmo & González-Catalán, 2024; Torres et al., 2023). More importantly, the present results suggest that the educational significance of Gemini lies not simply in the availability of AI-generated language but in the changing relationship between learner and tool across stages of composition. The finding therefore supports the argument that GenAI should be conceptualized as a dynamic form of scaffolding rather than merely an automated text-generation technology.

During planning, students used Gemini to broaden possible arguments, identify alternative perspectives, and generate counterarguments before establishing their own positions. This finding is consistent with research suggesting that generative AI can stimulate ideation and provide learners with multiple perspectives that may otherwise remain unexplored (Anwar, 2025; Qian, 2025). It also complements task-based approaches to critical thinking in which learners are encouraged to consider alternative claims and construct reasoned responses rather than reproduce predetermined information (Zhang, 2026). In the present study, the value of Gemini at this stage appeared strongest when learners treated suggestions as possibilities rather than completed answers. This distinction is theoretically important because idea expansion can enhance argumentative thinking only when students continue to exercise judgment over which alternatives deserve inclusion. Thus, the findings qualify optimistic accounts of AI-supported ideation: generating more arguments is not itself evidence of deeper reasoning unless learners subsequently discriminate among them.

The drafting stage revealed a different function. Students frequently used Gemini for grammar, vocabulary, academic register, transitions, and sentence clarity. This finding confirms earlier research showing that GenAI can provide accessible linguistic support and reduce difficulties associated with academic writing, particularly for learners writing in an additional language (Calle-Pesántez & Pallo-Chiguano, 2024; Saz-Pérez & Pizà-Mir, 2023; Vega et al., 2024). For EFL learners, such assistance may be particularly consequential because linguistic limitations can consume cognitive resources that might otherwise be directed toward argumentation. By helping students articulate already formed ideas more clearly, Gemini may create space for greater attention to reasoning. However, the findings also demonstrate that linguistic support and authorship cannot be separated completely. Some participants preferred to produce an initial version themselves before requesting AI assistance, suggesting that maintaining ownership of meaning remained important. This observation reinforces concerns raised by Figueroa and Eaton (2023), Molina (2024), and Torres et al. (2023) regarding transparency, authorship, and the preservation of student agency in AI-mediated academic work.

A particularly significant finding concerns the evaluation stage, where students compared Gemini-generated suggestions with task requirements, prior knowledge, course materials, and external sources. This finding supports the view that productive AI use depends on critical engagement rather than automatic acceptance (Adamakis & Rachiotis, 2025; Al-Fattal, 2025; Qian, 2025). Students who questioned relevance, reformulated prompts, rejected unsupported claims, or verified information demonstrated forms of evaluative reasoning that resemble the critical processes expected in argumentative writing. This result also resonates with Chang et al. (2023), who found that structured questioning can strengthen argumentative performance and critical thinking, and with Latifi et al. (2021), who emphasized the role of feedback processes in developing argumentative judgment. The present study extends these findings by showing that an AI system can become an object of evaluation itself. Rather than simply receiving feedback, learners evaluated the feedback provider, thereby adding another layer of epistemic judgment to the writing process.

Verification emerged as an especially important dimension of responsible AI use. Students distinguished between low-risk linguistic suggestions and higher-risk factual or evidentiary claims, often indicating greater willingness to accept grammatical assistance than unverified statistics, references, or factual statements. This pattern confirms longstanding concerns about hallucinated or fabricated information in GenAI systems (Dolmestch, 2023; Molina, 2024; Torres et al., 2023). It also supports recent calls to conceptualize AI literacy as involving source verification, awareness of system limitations, and accountability for evidence rather than simple operational competence (Adamakis & Rachiotis, 2025). The finding extends this literature by demonstrating that AI literacy may be domain-sensitive within a single writing task. Students did not necessarily trust or distrust Gemini globally; instead, they calibrated trust according to the type of assistance being requested. This suggests that pedagogical guidance should teach differentiated verification practices rather than treating all AI output as equally reliable or equally problematic.

Revision provided further evidence of higher-order reasoning. Students did not merely accept or reject suggestions but often modified them to better reflect their own stance, evidence, level of certainty, or linguistic identity. Such behavior is consistent with Al-Fattal's (2025) emphasis on comparison and reflection in GenAI-supported learning and with Ortiz et al. (2024), who associate feedback processes with self-regulated learning. It also aligns with Seran et al. (2025), whose conceptualization of AI-related cognitive dissonance highlights the intellectual tension created when AI output conflicts with a learner's existing knowledge or intentions. In the present study, this tension was potentially productive: disagreement with Gemini sometimes triggered closer consideration of claims, counterarguments, and rhetorical choices. The result therefore extends earlier research by suggesting that revision is not merely the final polishing stage of AI-assisted writing but a key site of metacognitive monitoring and epistemic negotiation.

The findings also demonstrate that reasoning was not produced automatically by exposure to Gemini. The same affordances that supported exploration and revision could also encourage cognitive offloading. Students reported difficulty formulating effective prompts, uncertainty about factual accuracy, temptation to adopt polished AI-generated passages, and concern about whether the resulting work remained authentically theirs. These challenges confirm concerns about dependence, academic integrity, and the potential erosion of independent thinking reported by Dolmestch (2023), Padilla (2024), Saz-Pérez and Pizà-Mir (2023), and Torres et al. (2023). They also reinforce Qian's (2025) argument that prompt engineering is an educational competence rather than merely a technical skill. Poor prompts can generate superficial outputs, while well-designed prompts can encourage explanation, comparison, and reflection. Consequently, the quality of AI-supported learning appears to depend significantly on interaction design.

An important contribution of the present study is therefore the distinction between cognitive scaffolding and cognitive substitution. Gemini functioned as scaffolding when students used it to generate alternatives, clarify language, test arguments, verify claims, or stimulate revision while retaining responsibility for final decisions. It approached cognitive substitution when students were tempted to adopt polished responses without sufficient evaluation. This finding contributes to current debates by showing that the educational value or risk of GenAI cannot be determined simply by whether students use the technology. Rather, it depends on what learners do with the generated output. This interpretation is consistent with research advocating reflective and structured GenAI use (Al-Fattal, 2025; Anwar, 2025; Qian, 2025; Roy et al., 2026), but it adds a process-oriented perspective by locating learner agency in discrete acts of accepting, rejecting, verifying, reformulating, and revising.

These findings have practical implications for EFL writing pedagogy. Educators should not limit AI instruction to rules about permitted or prohibited use. Instead, task design should

require learners to document prompts, justify why suggestions were accepted or rejected, verify factual claims, compare alternative AI responses, and explain significant revisions. Such practices would make reasoning visible and reduce the likelihood that linguistic fluency is mistaken for intellectual quality. Assessment should likewise distinguish between surface-level language improvement and deeper argumentative competence. This aligns with Figueroa and Eaton's (2023) emphasis on integrity-oriented AI practices and with Molina (2024) and Vega et al. (2024), who call for institutional and pedagogical frameworks that preserve accountability. In task-based EFL contexts, AI literacy should therefore encompass prompt formulation, rhetorical judgment, verification, reflective revision, and awareness of authorship boundaries.

CONCLUSION

This study demonstrates that Google Gemini can occupy multiple roles in task-based argumentative writing among EFL university students. Across planning, drafting, evaluation, and revision, learners used the tool to generate alternatives, develop initial arguments, refine linguistic expression, examine counterarguments, assess the relevance of suggestions, verify factual information, and reconsider their own rhetorical choices. The findings therefore challenge a simplified understanding of GenAI as either beneficial assistance or harmful dependence. Its educational value appears contingent on the quality of student engagement. When learners treated Gemini-generated content as provisional material to be questioned, compared, modified, and verified, the interaction created opportunities for evaluative reasoning, evidence-based decision-making, synthesis, and metacognitive monitoring. By contrast, the possibility of accepting polished responses without scrutiny revealed the continuing risk of cognitive offloading. The distinction between scaffolding and substitution therefore provides a useful way to understand AI-assisted argumentative writing: Gemini can expand learners' intellectual resources, but it does not itself guarantee deeper reasoning.

The study further indicates that effective integration of Gemini into EFL academic writing requires pedagogical structures that preserve student agency and epistemic responsibility. Learners need more than access to AI; they require explicit instruction in prompt construction, evidence verification, rhetorical evaluation, reflective revision, authorship, and ethical disclosure. Writing tasks should consequently require students to justify their interaction with AI rather than merely submit an improved final product. Such an approach would position AI literacy as part of academic literacy and would allow teachers to assess the quality of reasoning behind AI-assisted texts. Given the qualitative and context-specific nature of the present study, the findings should not be generalized statistically beyond the participants. Future research should investigate larger and more diverse EFL populations, compare different GenAI systems, examine disciplinary variation, and determine whether sustained AI-assisted writing strengthens or weakens independent argumentative competence over time. Nevertheless, the study contributes a process-oriented account of human-AI interaction by demonstrating that the most consequential aspect of Gemini-assisted writing is not the text that the system generates, but the intellectual decisions students make in response to that text.

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CONFLICT OF INTEREST

The authors declare that they have no financial, personal, professional, institutional, or other competing interests that could have influenced the design, conduct, analysis, interpretation, or reporting of this study. No relationships, activities, affiliations, or circumstances existed that could reasonably be perceived as compromising the objectivity, integrity, transparency, or independence of the research. The authors therefore confirm that this article was prepared and reported without any conflict of interest.

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INFORMED CONSENT STATEMENT

Participation in this study was entirely voluntary. All participants were informed about the purpose, procedures, potential risks, and anticipated benefits of the research before taking part. They were assured that their identities and personal information would remain confidential and that the information provided would be used solely for research purposes.

DATA AVAILABILITY STATEMENT

The data generated and analyzed in this study are not publicly available because of privacy, confidentiality, and ethical considerations concerning the protection of research participants. Access to the dataset may be granted by the corresponding author upon reasonable request for purposes such as verification or further scholarly analysis.

DECLARATION OF USING AI TOOLS

Generative artificial intelligence tools were used during the preparation of this manuscript to assist with language refinement, organization, and editorial improvement. The authors critically reviewed, verified, and revised all AI-assisted content and retain full responsibility for the accuracy, originality, interpretation, citations, and conclusions presented in the article. No AI tool was treated as an author or as a substitute for scholarly judgment.

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