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Multimodal AI Tools as Mediators of Linguistic Development in EFL Academic Writing

Oleksandr Tomchakovskyi
Department of Applied Linguistics and Literary Studies,
National university “Odesa law academy”, Odesa, Ukraine

[1]Yuliia Tomchakovska , [1,2] Lesia Strochenko , [1]Lidiia Shvelidze , [1]Svitlana Yeryomenko
[1]Department of Foreign Languages,
National University “Odesa Law Academy”, Odesa, Ukraine
[2]Corresponding Author: lesiastrochenko@gmail.com

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Abstract
Despite the growing adoption of artificial intelligence tools for drafting, revising, and editing of academic texts, little empirical evidence is available with respect to how multimodal AI-tools mediate linguistic development beyond being merely corrective or generative mechanisms. The research focuses on exploring the impact of current state-of-the-art multimodal AI systems on the development of academic writing proficiency among English as a foreign language learners at the National University "Odesa Law Academy," particularly in terms of linguistic development, genre knowledge, and agency. The research provides evidence on the effects of multimodal AI on critical aspects of academic writing, including the following: the sophistication of word-level variabilities, syntactical correctness and complexity; and the development of cohesion, coherence, and genre compliance and meta-linguistic comments during and after the writing process in academic texts. The research uses a mixed research methodology to compare student academic texts and evaluation on an additional perspective on patterns of interactions emerging from text, audio, and graphic research techniques and experimentation. It gives evidence that pedagogically mediated multimodal AI use is associated with enhanced academic vocabulary range, improved syntactic organization, and more coherent, genre-consistent writing. Interaction analysis shows how linguistic development is enabled via cross-modal transformations, visual feedback, iterative prompting, and oral-written mediation that together foster noticing and scaffolded revision. At the same time, the study highlights several risks related to over-reliance on AI, homogenization of academic voice, and reduced self-regulation when AI use is insufficiently guided. This paper adds to existing debates on AI, academic literacy, and integrity in higher education by conceptualizing multimodal AI as a mediational resource rather than a surrogate author.

Keywords: Academic literacy, artificial intelligence, English as a foreign language academic writing, genre awareness, higher legal education, linguistic development, multimodal AI, multimodality

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Introduction

The rapid growth of artificial intelligence (AI) in education has changed how foreign language learners tackle academic writing. This tool combines text, audio, visuals, and interactive features. Instead of just being simple aids, these tools have become essential for language development. Their ability to generate, change, and organize language input connects them to cognitive processing, digital literacy, and second language learning (Du & Daniel, 2024). For English as a foreign language (EFL) learners, who often find academic vocabulary, discourse structure, genre conventions, and appropriate usage challenging, this technology provides unmatched chances for personalized, adaptable, and context-sensitive support (Markus & Kirner-Ludwig, 2024).

The multimodality within contemporary applied linguistics conceptualizes a dynamic semiotic space wherein meaning is co-constructed through the interaction of multiple communicative channels. AI-driven environments expand this space with real-time linguistic modelling, multimodal feedback, and interactive problem-solving, thus activating deeper cognitive operations central to academic writing development. Combining visual prompts with speech synthesis, conversational agents, knowledge retrieval systems, and generative text models, an individual learning ecology is created that fosters noticing, scaffolding, iterative revision, and metalinguistic reflection – the very mechanisms championed by sociocognitive theories of second language (L2) writing and speaking (Wang et al., 2024).

Despite the rapid adoption of tools like ChatGPT, Grammarly, Elicit, and multimodal large language model (LLM) interfaces, empirical research into their mediating role in EFL academic writing is at an early stage. Current debates centre around issues of linguistic authenticity, academic integrity, learner agency, and the shifting nature of writing competence in AI-rich environments. Meanwhile, emerging evidence suggests that multimodal AI can promote lexical diversity, syntactic accuracy, cohesion, and genre awareness when used as a pedagogically mediated resource rather than as a surrogate author.

The research aims to investigate how multimodal AI tools function as mediators of linguistic development in EFL academic writing, with a particular focus on their impact on the writing practices, linguistic performance, and metalinguistic awareness of students at the National University “Odesa Law Academy.” Conceptually, this research endeavors to detail the mechanisms through which the use of multimodal AI enhances learners' academic literacy, supports cognitive and discourse processes, and contributes to the formation of genre-specific competencies in legal and academic communication.

The following research questions inform the exploration: how multimodal AI tools mediate the linguistic development of the academic writing of EFL students at the National University "Odesa Law Academy"; which of the linguistic dimensions-vocabulary sophistication, syntactic accuracy, cohesion, coherence, and genre conventions-indicates the most substantial improvement when students employ AI-mediated support; what emerging patterns of multimodal interaction appear during the processes of drafting, revising, and conceptualising academic texts supported by AI; what the students' perceptions are about the pedagogical and ethical implications entailed in making use of such tools, like over-reliance, authenticity, and academic integrity concerns; and what principles should ground the responsible integration of AI into academic writing instruction in law-focused higher education.

In order to answer these questions, the research provides several interrelated tasks: to analyze current theoretical approaches to multimodality, AI-mediated learning, and EFL academic

writing development; to identify and classify the multimodal AI tools most commonly used by students; to examine linguistic features of student academic texts produced both with and without AI support; to explore multimodal interaction patterns that characterise students' engagement with AI at various stages of the writing process; to evaluate student perceptions concerning the benefits, risks, and cognitive effects of AI use; to determine the pedagogically justified conditions for enhancing, rather than substituting, learners' linguistic production, and; to formulate methodological recommendations to integrate multimodal AI tools into EFL academic writing instruction at the National University "Odesa Law Academy."

Literature Review

Research on academic writing, multimodality, and AI has grown quickly in recent years. This trend reflects larger changes in higher education and digital literacy. Studies on developing academic writing highlight the complex linguistic, rhetorical, and cognitive demands on learners, especially those studying in EFL contexts. Ahmad, Mahmood, and Siddique (2023) show that dissertations in both hard and soft sciences have unique linguistic features. These include genre-specific word patterns and sentence structures, emphasizing the need for clear academic literacy training. Ongoing writing challenges identified in earlier work (AlMarwani 2020) involve a lack of vocabulary, organizational issues, and limited understanding of academic conventions. Additionally, Gupta et al. (2022) found that international doctoral students often depend on feedback from supervisors and help from institutions to navigate unfamiliar academic genres.

At the same time, studies on AI in language education reveal promising progress along with new concerns. Crompton and Burke (2023) argue that AI use has reached a turning point in higher education, where smart tools increasingly shape learning methods, assessment practices, and curriculum design. Research on AI-assisted English language learning shows improvements in student outcomes. Cao (2019) notes that AI-driven platforms enhance English proficiency. Chung and Bong (2024) demonstrate better understanding of accented English through AI-supported pronunciation training. These results support broader analyses of AI in education, which highlight its potential to personalize learning, provide automated feedback, and aid differentiated instruction (Drach et al., 2023; Editor's Note, 2024; Pisica et al. 2023). However, concerns about safety, over-reliance, and reduced learner autonomy appear regularly in studies by Ahmad et al. (2023) and Patty (2024). They warn that too much dependence on AI tools may weaken critical thinking and independent problem-solving skills.

The emergence of AI-generated feedback systems has prompted new investigations into their cognitive and affective impact. Mohammed and Khalid (2025) report that AI-generated writing feedback can enhance motivation: "Learners emphasized that feedback specificity – focusing on grammar, vocabulary, and coherence – encouraged them to improve their writing skills more actively. They felt motivated to revise and improve because the AI feedback was immediate and focused on areas for improvement rather than just providing general comments" (p. 16). Wale and Kassahun (2024) explore the use of AI within collaborative writing environments such as Google Docs, arguing that these hybrid spaces promote iterative revision, richer lexical choices, and increased learner engagement. Their findings resonate with higher education writing support literature that emphasises the importance of social interaction, metacognitive reflection, and guided revision processes (Tremblay-Wragg et al. 2021; Tyndall and Powell 2023).

Multimodality also constitutes a critical dimension of contemporary L2 writing research. The polycode nature of digital learning environments, where written, visual, and auditory modes

interact, shapes how learners process linguistic input and construct meaning. Kolegaeva et al. (2020) demonstrate how polycode resources in learner dictionaries enhance lexical comprehension and facilitate cross-modal semantic mapping: "Using pictographic illustrations in the learning process optimizes the readers' activity of searching, understanding, and memorizing the necessary information" (p. 252). In broader teaching contexts, Bakai et al. (2023) argue that using multimodal resources in foreign language instruction improves both communication skills and cognitive flexibility. The blend of multimodality and AI creates a useful framework for examining how modern learners approach academic writing tasks.

However, experts also emphasize the importance of balance and critical oversight. Discussions about AI in higher education warn against replacing basic writing instruction with automated systems. They point out that lasting learning needs human involvement, thoughtful practice, and ethical understanding (Crompton & Burke 2023; Pisica et al. 2023). Similarly, new teaching literature shows that writing development works best when learners actively engage with models, negotiate meanings, and make deliberate choices about language and structure (Gupta et al. 2022; Tremblay-Wragg et al. 2021).

Together, these sources highlight several key themes relevant to the current study: the ongoing challenges of EFL academic writing (Ahmad et al. 2023; AlMarwani 2020), the transformative yet debated role of artificial intelligence in language learning (Cao 2019; Crompton & Burke 2023; Wale & Kassahun 2024), the cognitive and emotional aspects of AI-driven feedback (Mohammed & Khalid 2025), and the teaching potential of multimodal, polycode environments (Bakai et al. 2023; Kolegaeva et al. 2020). This literature offers the conceptual and empirical basis for exploring how multimodal AI tools influence linguistic growth in the academic writing of EFL students. It also highlights the need to look at both the advantages and the downsides of these tools in higher legal education.

Methodology

This study will use a combined methodology based on cognitive-discursive, multimodal, and applied linguistics approaches to explore how multimodal AI tools affect the language development of EFL students in academic writing at the National University "Odesa Law Academy." We combined qualitative and quantitative methods to capture the language outcomes of AI-mediated writing and the underlying cognitive-interactional processes.

The empirical material for this study includes 120 academic texts written by second- and third-year English for Academic Purposes students in the Faculty of Law. These texts consist of analytical essays, summaries, research abstracts, and short literature reviews. For each participant, we collected two comparable texts: one written independently (60 texts in total) and one created with the help of multimodal AI tools, including the ChatGPT multimodal interface, Grammarly, Elicit, speech-to-text systems, and visual prompt generators (60 texts in total). This paired sample allows us to observe changes in vocabulary choice, sentence structure, cohesion, and genre realization linked to AI mediation.

We analyze the corpus using a mixed approach. The linguistic analysis focuses on lexical sophistication, which includes type-token ratio, academic vocabulary range, and collocational accuracy, as well as syntactic complexity, such as clause density, subordination, and error rates. We also look at cohesion, whether through reference, conjunction, or thematic progression, and the genre-specific features of academic and legal discourse. We investigate these parameters using methods like concordancing, frequency profiling, and automated metrics, along with expert

manual annotation. By comparing AI-mediated texts to those written independently, we can measure the degree and nature of language development.

The study also looks at the multimodal traces of student-AI interaction to understand the dynamics of AI use. We analyze screenshots of prompts, revisions generated by AI, audio-to-text transformations, and visual supports. This discourse analysis helps identify common patterns of mediation, such as iterative refinement, feedback loops, genre prompting, cross-modal re-encoding, or over-reliance on AI-generated content. These findings are viewed through the lens of sociocognitive writing theories, emphasizing scaffolding, noticing, and distributed cognition.

Additionally, we explore students' perceptions of AI-mediated writing using semi-structured questionnaires and short reflective commentaries. This qualitative data provides insight into learners' experiences, perceived benefits and challenges, cognitive load, and concerns about authenticity and academic integrity. By triangulating text analysis, interactional data, and learner reflections, we ensure a multifaceted view of the role that multimodal AI tools play in developing academic writing skills.

The methodological framework blends corpus-based analysis, multimodal discourse analysis, and learner-centered qualitative inquiry seamlessly. This integrated approach lays the groundwork for deeper insights into the linguistic, cognitive, and educational effects of multimodal AI mediation in EFL academic writing at the National University "Odesa Law Academy."

Results

The results of the analysis of students' practices at the National University "Odesa Law Academy" demonstrated a stable repertoire of multimodal AI tools in current use during the performance of EFL academic writing. These tools can be classified into several categories based on their function and modality features. Text-generation and revision systems, essentially large language models like ChatGPT, have become popular for drafting, paraphrasing, and perfecting academic prose. Their multimodal extensions allow students to work with images, tables, and screenshots, which facilitates comprehension of complex legal or academic input and supports the transformation of visual prompts into coherent written text.

A second group consists of AI-based corrective and diagnostic tools, including Grammarly, QuillBot, and DeepL Write. Students use them for automated feedback on grammar, punctuation, register, and cohesion. These systems incorporate multimodal dashboards that highlight errors visually, provide color-coded explanations, and often include audio or interactive examples of correct structures. Research-assistance tools form a third category: platforms like Elicit or Semantic Scholar's AI assistant offer summarization, citation extraction, and cross-modal presentation of scientific sources, helping students navigate disciplinary literature. Finally, speech-text and audio-supported systems-Google Speech-to-Text, Whisper-based tools, and AI note-taking assistants-are employed by learners who prefer to draft orally or who rely on auditory prompts to support lexical retrieval and syntactic planning.

The analysis of linguistic features in academic texts produced both with and without AI support has revealed several striking trends. AI-mediated texts indicated higher lexical sophistication, especially in such areas as academic verbs, nominalisations, and discipline-specific lexis relevant to legal and socio-humanities writing. Students working with AI demonstrated more accurate collocations and increased control over cohesive devices, especially in reference chains and conjunctive relations.

AI-supported text was syntactically more complex: it included more subordinate clauses, used complex noun phrases more frequently, and contained fewer sentence-level errors. At the same time, a fair number of instances revealed that syntactic complexity at times reflected AI-driven formulations rather than actual learner development; hence, pedagogical mediation to ensure that students internalize advanced structures, rather than merely import them, is required.

Genre analysis showed that the AI-generated texts conformed more regularly to academic conventions. The problem statement was more explicit in the introductions, the body paragraphs had a more linear thematic progression, and the conclusions were more explicitly related to the assignment's aims. The independently written texts, on the other hand, were more heterogeneous in their organisation and often lacked explicit signalling of academic moves.

On the other hand, the analysis also unveiled some challenges: over-formalisation and homogenised phrasing in some AI-mediated texts told of reliance upon AI-generated templates rather than any student-driven composition. Student voice was more salient in independently written versions, although sometimes at the expense of precision and coherence.

The results showed that students interact with AI differently at different stages of the composing process, combining text, visual, and audio modalities rather than relying on linear, text-only prompting. At the planning stage, many learners used multimodal AI tools to transform non-textual or complex materials into manageable input. For instance, a student working on a course paper about human rights law uploaded a screenshot of a legal article and asked the AI to "summarise this for the introduction in simpler academic English" and "highlight three key issues I can discuss." The summary and bullet-pointed issues generated by AI then served as a conceptual map for the student's own outline. In such cases, cross-modal re-encoding (image → text) and conceptual scaffolding characterize the interaction pattern, where AI helps structure the content space well before any complete written draft appears.

One noticeable pattern in this initial drafting involved oral-written mediation. Some students dictated an overall rough English draft, based on ideas in L1 or in L2, then imported that draft into a language model for refinement. A typical sequence was to dictate something like: "In my opinion artificial intelligence is fundamental technology which changing legal profession," then paste the transcribed text into the AI and request "rewrite this as a formal academic paragraph for a course paper in law, B2–C1 level." The AI's rewritten version was compared to the original, with the student commonly asking follow-up questions like "why is this phrasing better?" or "keep my structure but correct grammar." This interaction pattern brings together oral production, automated transcription, and metalinguistic feedback, inviting learners to notice contrasts between their output and a more target-like model.

In the revision stage, interaction patterns were dominated by visual feedback and iterative refinement. Tools such as Grammarly or AI-enhanced editors highlighted errors through colour-coding, underlining, and side-panel explanations, often linked to short pop-up examples. Students tended to move back and forth between these visual cues and the main text, accepting, rejecting, or modifying suggestions. For example, a student revising a literature review might see the phrase "make an important contribution for legal practice" highlighted, click on the explanation, and select the AI-suggested alternative "make an important contribution to legal practice" while simultaneously asking a language model in another window: "Explain why we use contribution to, not contribution for, and give me two more examples in academic style." This reflects a feedback-loop pattern, where visual error signalling in one interface triggers metalinguistic inquiry in another, effectively distributing the revision process across multiple AI resources.

Another salient pattern involves genre prompting and move structuring. Students working on introductions, abstracts, or conclusions were found to frequently use textual prompts focused on rhetorical moves, such as "help me write an introduction with background, problem statement, aim, and structure of the paper for an article on AI in legal education." On receiving a model paragraph, some learners asked AI to highlight the sections corresponding to each particular rhetorical move, or even to rewrite just a section or two, for instance, "rewrite only the problem statement, keep the aim and structure unchanged." In some instances, students pasted their own version next to the AI-generated one and asked: "Compare these two introductions and show me where mine is weaker in terms of academic style." Here, AI functions as a multimodal genre tutor, as text is accompanied by visual segmentation, annotations, and sometimes tables listing rhetorical functions, which all together guide the learner in internalising academic discourse structures.

The final editing stage often involved cross-platform, cross-modal chaining. A typical workflow included drafting and revising in a word processor with integrated AI suggestions, checking grammar and register in a separate tool, and finally using a language model to verify coherence and adherence to task requirements. One student, for example, copied the almost-final version of a course paper abstract into a chat-based AI and asked: “Check if this abstract meets typical requirements for a linguistics article: 150–200 words, clear aim, methods, results, and value; underline what is missing.” The AI returned a visually highlighted version, underlining the absent or weakly expressed components. This pattern shows AI acting as a meta-evaluator of genre completeness, with visual highlighting and brief textual justifications inviting the student to make targeted micro-revisions rather than rewriting globally.

Across these stages, the interaction patterns present a number of shared features: frequent switching between modalities of image, speech, and text; heavy reliance on visual signaling and annotation to guide attention; and a cyclical, rather than linear, way of engaging with the text. The results are presented in Table 1.

Table 1. *Frequency of multimodal interaction patterns (AI-mediated texts, N = 60)*

Interaction pattern	Number of texts	Percentage (%)	Dominant writing stage
Cross-modal re-encoding (image → text)	42	70%	Planning
Oral-written mediation	31	52%	Drafting
Visual feedback loop	54	90%	Revision
Iterative prompting	47	78%	Drafting/revision
Genre prompting and move structuring	39	65%	Drafting/editing
Cross-platform chaining	28	47%	Editing

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The most common pattern is the visual feedback loop, which was found in 90% of the texts and expresses a pervasive reliance of students on visually signalled corrective feedback provided during the revision stage, such as colour-coding, underlining, and side-panel explanations. What this finding suggests is the central role of the visual attention-guiding mechanism in fostering error noticing and refinement. Iterative prompting and cross-modal re-encoding further indicate that learners actively transform information across modalities, especially at the planning and drafting stages, where images, screenshots, and structured prompts are converted into written academic content. The relatively high occurrence of genre prompting and move structuring suggests that AI tools function not only as linguistic correctors but also as genre mediators in supporting students' awareness of rhetorical organisation in academic and legal writing. Oral-written mediation, which occurred in somewhat more than half of the texts (52%), underlines the role of speech-based drafting in lexical retrieval and syntactic planning for those learners who initially outline ideas orally. Cross-platform chaining, 47%, reflects advanced use of AI where, in the final editing stage, students combine multiple tools to check coherence and completeness regarding genre. Simultaneously, the data suggest considerable variation in learner agency. At the same time, some students used AI as a dialogic partner by repeatedly asking "why" and "how," for others, it remained largely an easy source of ready-made formulations and templates. This suggests that explicit pedagogical guidance is necessary if multimodal interaction patterns are to be harnessed toward promoting linguistic development through noticing, reflection, and gradual appropriation of academic norms, rather than passive dependence on AI-generated language.

Questionnaire data and reflective commentaries suggest that for students at the National University "Odesa Law Academy," multimodal AI tools are perceived as simultaneously empowering and potentially problematic. The most frequently reported benefits concern linguistic support: learners emphasize the tools' capacity to "correct small details I do not see," provide "more academic vocabulary," and help "sound like real academic writers." Many respondents report reduced anxiety and cognitive load at the initial drafting stage, referring to AI as a "starting point" or "thinking partner" that helps overcome writer's block, clarify task requirements, and structure ideas. Several students report that visual and color-coded feedback facilitates noticing of recurrent grammatical and lexical errors, which they begin to anticipate and avoid even without AI assistance.

At the same time, students are acutely aware of risks and ambivalent cognitive effects. A substantial proportion expresses concern about over-reliance, admitting that "sometimes it is easier to accept everything" than to evaluate AI suggestions critically. Some report a feeling of "voice loss," where AI-generated formulations no longer reflect their personal stance or linguistic identity. Others indicate the danger of "switching off thinking" when the tool produces seemingly perfect text, particularly under time pressure. Ethical concerns are also salient: students recognize the fine line between legitimate language support and concealed ghostwriting, and many associate uncritical copying of AI output with breaches of academic integrity. Cognitive reflections thus oscillate between viewing AI as a scaffold that expands their zone of proximal development and as a shortcut that may weaken self-regulation and independent problem-solving.

Based on these perceptions and the linguistic analysis of texts, several pedagogically justified conditions emerge that enhance rather than substitute learners' linguistic production. First, AI use is most productive when embedded in explicitly staged writing tasks, where learners must produce an initial version on their own and only then consult AI for targeted refinement. Second, the tools function as genuine mediators of development when students are required to compare

their own output with AI suggestions, justify accept/reject decisions, and articulate the linguistic principle underlying each change. Third, cognitive benefits are maximised when AI is positioned not as a generator of final text but as a provider of options, exemplars, and metalinguistic explanations that learners must appropriate and recontextualise in their own words. Finally, clear institutional guidelines on permissible AI use reduce ethical ambiguity and strengthen students' capacity to distinguish support from substitution.

These conditions frame a set of methodological suggestions for integrating multimodal AI tools into EFL academic writing instruction at the National University "Odesa Law Academy." Courses in writing should include explicit AI-literacy components that familiarize students with the affordances and limitations of different tools, their multimodal interfaces, typical error patterns, and biases regarding register and genre. For instance, classroom activities can be usefully built around the contrastive analysis of "student vs AI" versions of the same paragraph, followed by discussions focusing on precision, cohesion, and genre appropriateness, rather than on "better English" in general. Instructively, there is a premium on process-oriented assignments where students can submit drafts, AI prompts, and revision histories in order to make multimodal interaction patterns visible and available for reflection.

Furthermore, assessment practices can be designed to include components that cannot be outsourced to AI, such as in-class micro-writings, oral defence of written work, and reflective commentaries on language choices. Students can be systematically trained to use AI for specific micro-tasks - generating lexical alternatives, checking collocations, clarifying the function of discourse markers, or modelling rhetorical moves - while remaining responsible for the overall conceptual and argumentative architecture of the text. Such an approach would align AI use with the goals of developing autonomous academic writers: multimodal tools become instruments for noticing, practice, and refinement, rather than replacements for the learner's own linguistic and cognitive effort.

Discussion

The present study contributes to a nuanced answer to the question of how multimodal AI tools mediate linguistic development in the academic writing of EFL students at the National University "Odesa Law Academy." The analysis shows that AI tools do not merely correct surface-level errors but represent complex mediating systems that shape lexical sophistication, syntactic organisation, cohesion, genre awareness, and metalinguistic reflection. Students' interaction patterns unfold that multimodal AI-through visual highlighting, cross-modal transformations, iterative feedback loops, and multimodal prompting-creates cognitive conditions that foster noticing, scaffolding, guided revision, and strategic deployment of academic discourse features. At the same time, results showed that the very developmental potential of AI is highly dependent on pedagogical framing: without structured guidance, students risk over-reliance, homogenisation of voice, or superficial incorporation of AI-generated phrasing.

Comparing these results to the existing body of research reveals various points of convergence and divergence. The improved lexical diversity and academic register manifest in AI-mediated texts resonate with the gains recorded by Wale and Kassahun (2024), who noted that AI writing technologies embedded within collaborative platforms significantly enhance lexical accuracy and cohesion. Both studies stress that AI facilitates learners' adoption of academic vocabulary and discourse markers. However, our findings point out that such benefits are realized

to the fullest when students engage in active comparison and justification of linguistic choices rather than passively accepting AI output.

The syntactic enhancements highlighted in this study-increased subordination and more accurate complex noun phrases-are closely related to the findings of Mohammed and Khalid (2025), who established that AI-generated feedback enhances structural complexity and writing confidence, provided that learners continue to engage reflectively. However, beyond Mohammed and Khalid's findings, our results stress a risk that excessive syntactic refinement may reflect the AI's linguistic template rather than authentic learner mastery. This is to say that while AI can model structures at an advanced level, it needs to be combined with instructional activities that stimulate learners to internalize and reproduce these structures autonomously.

The uncovered multimodal interaction patterns thus also echo the observations of Kolegaeva et al. (2020) regarding the pedagogical value of polycode environments. Their research into polycode learner dictionaries demonstrated that cross-modal representations facilitate semantic clarity and lexical acquisition. In their turn, our findings suggest that AI platforms offering visual error signalling, image-to-text transformations, and multimodal annotation support a deeper processing of academic writing conventions. Unlike polycode dictionaries, however, AI writing tools add a generative dimension in encouraging learners to negotiate meaning with a dynamic partner rather than consult static representations.

Our findings align with those of Ahmad et al. (2023), who note possible risks in terms of reduced self-regulation and greater reliance on automated systems at the cognitive and affective dimensions. Similarly, students in this study raised concerns, detailing how they would “switch off thinking” when the AI produced text that seemed much too polished. This contrast between perceived cognitive relief and possible cognitive stagnation highlights the need for explicit pedagogical safeguards. Nevertheless, our findings depart from Ahmad et al. in that we show how structured reflection—such as inviting students to explain why a correction is better—can mitigate risks and turn AI use into a cognitively generative process.

Finally, the improvements in organisation, rhetorical clarity, and genre-move realisation seen are aligned with the challenges and needs profiled by AlMarwani (2020) and Gupta et al. (2022). Structure, coherence, and disciplinary conventions are shown to be problematic in both studies for EFL learners. The current research underscores these findings but goes further to suggest that multimodal AI tools act not only as correctors but as genre tutors visually segmenting moves, modeling model rhetorical structures, and facilitating iterative restructuring. However, the homogenizing potential of academic voice created by AI emerges as a serious new issue in AI-rich academic environments.

Overall, the comparative analysis reinforces the conclusion that multimodal AI tools are powerful but pedagogically sensitive mediators of linguistic development. Their effectiveness depends not so much on the tools as such but rather on how learners are instructed to approach them: in a critical, reflective, and strategic manner. The findings support prior research proving that AI can yield positive impacts on writing results (Wale & Kassahun 2024; Mohammed & Khalid 2025) while at the same time confirming suspicions of overdependence and cognitive passivity (Ahmad et al. 2023). They also extend the focus on multimodality studies (Kolegaeva et al. 2020) by showing exactly how specific multimodal interaction patterns shape EFL academic writing processes.

Taken together, these findings suggest that multimodal AI has the potential to enhance academic writing competence if deployed within a pedagogical framework emphasizing independent drafting, informed comparison, iterative reflection, and ethical academic practice.

Conclusion

The present study has already demonstrated that multimodal AI tools serve as significant mediators that promote linguistic development in EFL students engaged in academic writing at the National University "Odesa Law Academy." Thus, textual, visual, and audio modalities combine to support learners in all stages of the writing process-planning, drafting, revising, and final editing-while enhancing lexical sophistication, syntactic accuracy, cohesion, and genre awareness. In this context, analysis has shown that the pedagogical value of AI lies not in generating polished text itself but rather in creating cognitive and interactional conditions that promote noticing, reflection, and informed linguistic choice. At the same time, the data also bring into sharp relief several risks associated with over-reliance, loss of authorial voice, and reduced self-regulation, which again underlines the need for structured pedagogical mediation. That said, a judiciously integrated multimodal AI can assume a supportive scaffold role, strengthening academic literacy while preserving agency and integrity. Altogether, the insights from this study contribute to the current debate on responsible AI use in higher education and provide a set of principles for integrating multimodal AI into EFL academic writing instruction in a manner that enhances, rather than substitutes, learners' own linguistic production.

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About the Authors:

Oleksandr Tomchakovskyi, PhD in philology, associate professor of the Department of Applied linguistics and literary studies, Faculty of Journalism, National university "Odesa law academy", Odesa, Ukraine. In 2017 he was a mentor for the starting teachers of English in the MENA countries (TESOL Arabia). His research interests are English for Specific Purposes, English Lexicography. E-mail: v29846501@gmail.com
ORCID ID: https://orcid.org/0000-0001-6586-8095

Yuliia Tomchakovska, doctor of philological studies, associate professor, Head of the Department of Foreign Languages, Faculty of Civil and Economic Justice, National university "Odesa law academy", Odesa, Ukraine. Her research interests are Language Teaching and Learning, English for Specific Purposes. E-mail: yuliya.tomchakovskaya@gmail.com
ORCID ID: http://orcid.org/0000-0003-0117-2704

Lesia Strochenko (corresponding author**)**, doctor of philological sciences, associate professor, professor of the Department of Foreign Languages, Faculty of Civil and Economic Justice, National university "Odesa law academy", Odesa, Ukraine. Her research interests are Language Teaching and Learning, English for Specific Purposes, Cognitive Linguistics.
E-mail: lesiastrochenko@gmail.com
ORCID ID: https://orcid.org/0000-0003-3619-3484

Lidiia Shvelidze, PhD in philology, associate professor of the Department of Foreign Languages, Faculty of Civil and Economic Justice, National university "Odesa law academy", Odesa, Ukraine. Her research interests are Language Teaching and Learning, English for Specific Purposes, Media studies. E-mail: 9087000@gmail.com
ORCID ID: https://orcid.org/0000-0003-2291-5255

Svitlana Yeryomenko, PhD in philology, associate professor of the Department of Foreign Languages, Faculty of Civil and Economic Justice, National University "Odesa Law Academy", Odesa, Ukraine. Her research interests are Language Teaching and Learning, English for Specific Purposes, and Translation. E-mail: svetlana200125@gmail.com
ORCID ID: https://orcid.org/0000-0002-8145-9483

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