



A BIBLIOMETRIC ANALYSIS OF AWE IN ACADEMIC WRITING: INSIGHT FROM THE SCOPUS DATABASE

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Diterima: 30/5/2026; Direvisi: 10/6/2026; Diterbitkan: 16/6/2026

ABSTRAK

Penelitian ini mengkaji perkembangan dan tren penelitian Evaluasi Tulisan Otomatis (Automated Writing Evaluation/AWE) dalam penulisan akademik melalui pendekatan bibliometrik. Sebanyak 75 dokumen diperoleh dari basis data Scopus, mencakup publikasi antara tahun 2015 dan 2025, dan dianalisis menggunakan VOSviewer. Analisis difokuskan pada tiga dimensi: (1) analisis tren publikasi untuk memetakan pertumbuhan penelitian AWE dari waktu ke waktu; (2) analisis ko-kemunculan kata kunci untuk mengidentifikasi konsep dominan dan kluster tematik; dan (3) pemetaan tematik untuk mengungkap arah penelitian yang sedang berkembang dan peluang di masa mendatang. Temuan menunjukkan tren peningkatan signifikan dalam output penelitian AWE, dengan volume publikasi yang tetap moderat antara 2015 dan 2021 sebelum meningkat tajam sejak 2022, dengan puncaknya 22 dokumen pada tahun 2025. Analisis kata kunci mengidentifikasi "automated writing evaluation" sebagai konsep sentral (kemunculan = 34; Total Link Strength = 96), yang terhubung erat dengan "feedback" (TLS = 38), "artificial intelligence" (TLS = 36), "ChatGPT" (TLS = 35), dan "natural language processing" (TLS = 30). Tiga kluster tematik utama teridentifikasi: kluster berorientasi teknologi mencakup alat AI dan NLP; kluster umpan balik dan penilaian berpusat pada fungsi pedagogis AWE; dan kluster pembelajaran bahasa menonjolkan penerapan dalam konteks penulisan akademik bahasa kedua (L2) dan EFL. Hasil penelitian mengungkap transisi mendasar dalam bidang ini, dari sistem penilaian otomatis konvensional menuju mekanisme umpan balik formatif berbasis AI yang lebih canggih. Temuan ini berkontribusi pada pemahaman yang lebih terstruktur tentang lanskap intelektual penelitian AWE dalam penulisan akademik.

Kata Kunci: *Evaluasi Tulisan Otomatis, Penulisan Akademik, Analisis Bibliometrik*

ABSTRACT

This study investigates the development and research trends of Automated Writing Evaluation (AWE) in academic writing through a bibliometric approach. A total of 75 documents were retrieved from the Scopus database, covering publications between 2015 and 2025, and were analyzed using VOSviewer. The analysis focused on three dimensions: (1) publication trend analysis to chart the growth of AWE scholarship over time; (2) keyword co-occurrence analysis to identify dominant concepts and thematic clusters; and (3) thematic mapping to reveal emerging research directions and future opportunities. The findings reveal a marked upward trend in AWE research output, with publication volume remaining modest between 2015 and 2021 before rising sharply from 2022 onward, culminating in 22 documents in 2025 alone. Keyword analysis identified "automated writing evaluation" as the central concept (occurrences = 34; Total Link Strength = 96), closely networked with "feedback" (TLS = 38), "artificial



intelligence" (TLS = 36), "ChatGPT" (TLS = 35), and "natural language processing" (TLS = 30). Three major thematic clusters were identified: a technology-oriented cluster encompassing AI and NLP tools; a feedback and assessment cluster centered on the pedagogical functions of AWE; and a language learning cluster foregrounding applications in second language (L2) and EFL academic writing contexts. The results further reveal a fundamental transition shifting from conventional automated scoring systems toward more sophisticated, AI-powered formative feedback mechanisms. These findings advance a more structured understanding of the intellectual landscape of AWE research in academic writing and identify concrete directions for future inquiry.

Keywords: *Automated Writing Evaluation, Academic Writing, Bibliometric Analysis*

INTRODUCTION

Academic writing has undergone significant transformations in the digital age, becoming an essential vehicle for dissemination. Universities now place greater emphasis on research and scholarly publication, making effective writing skills a key requirement for both students and academics. Academic writing serves not only as a crucial means of international communication but also as a fundamental tool for building knowledge, fostering critical thinking, and supporting long-term academic career development worldwide (Hyland, 2019). Ideally, scholars should be able to produce coherent, well-structured, and rhetorically sound manuscripts that meet the rigorous standards of high-impact international journals. However, for non-native English speakers, mastering complex academic writing conventions remains a persistent and daunting challenge, particularly regarding advanced grammar, rhetorical coherence, academic writing style, and persuasive argumentation (Raitskaya & Tikhonova, 2020; Salu et al., 2025; Tikhonova & Mezentseva, 2024; Xu et al., 2024; Zhang et al., 2025). This linguistic barrier often creates a significant gap between the actual output of researchers from developing countries and the strict expectations of the global scientific community. Consequently, there is an urgent and continuous need for effective pedagogical interventions and technological support systems that can help bridge this proficiency gap and democratize global knowledge production.

To address these challenges, the field of educational technology has developed Automated Writing Evaluation as an innovative instructional solution. Initially, AWE was merely a simple *spell-checker*, but it has since evolved into a highly sophisticated system leveraging *natural language processing* and *machine learning*. A comprehensive bibliometric analysis has successfully traced the historical trajectory of AWE technology from basic grammar tools to highly intelligent writing evaluation systems (Barrot, 2023). Contemporary AWE platforms such as Trinka, Grammarly, ProWritingAid, and Pigai.org now provide immediate and contextual feedback on various aspects of writing, including idea organization, paragraph development, academic style, and technical accuracy. Meta-analytic findings officially confirm that these advanced AWE tools facilitate writing ability at a statistically significant level (SMD = 0.422, $p < 0.001$), underscoring their immense pedagogical value in modern language classrooms (Xue, 2024). These systems allow learners to engage in formative revision cycles independently, transforming the traditional teacher-centered feedback model into an interactive, student-driven learning process that enhances autonomy (Alghamdy, 2023; Escalante et al., 2023; Jalambo et al., 2025; Lin, 2025).

Although research on automated evaluation continues to grow rapidly, existing studies remain scattered across various journals and have not yet been fully integrated. Bibliometric



analysis can be used effectively to identify publication patterns, citation networks, and quantitative developments within specific research themes over a defined period (Donthu et al., 2021). Researchers have recently used sophisticated bibliometric tools such as Bibliometrix, VOSviewer, and Biblioshiny to map the thematic evolution of EFL writing assessment, explicitly identifying AWE and artificial intelligence as rapidly emerging themes (Ardiana et al., 2025). However, a significant gap remains because research specifically mapping the development of AWE within the specialized domain of academic writing based on the Scopus database remains remarkably limited. This lack of synthesis creates an epistemological gap, as educators and researchers cannot easily grasp the comprehensive intellectual structure, historical milestones, or collaborative networks that have shaped this rapidly evolving field over the last decade, thereby hindering strategic academic planning.

This empirical gap becomes more evident when examining the scope of recent literature reviews and meta-analyses. For instance, a comprehensive review used Web of Science data covering the period from 2008 to 2023, while another study examined writing in the era of large language models (Litvinova et al., 2024; Xue, 2024). Similarly, other researchers focused exclusively on the Pimai.org system within the Chinese educational context, limiting geographical generalizability (Xiao et al., 2024). This collective gap implies that the global knowledge structure of AWE specifically in academic writing has not yet been clearly mapped, making it difficult to predict future research directions, particularly regarding *genre-based* AWE, student feedback literacy, and the ethical integration of responsible generative artificial intelligence. Without a clear thematic mapping, the academic community risks duplicate research efforts and may miss critical opportunities to align automated tools with modern pedagogical theories, such as process-oriented writing and collaborative learning paradigms in higher education.

To address these identified research gaps, this study presents a novel, comprehensive bibliometric synthesis exclusively focused on Scopus-indexed literature, guided by three distinct research questions: (1) What is the exact publication trend of AWE research in academic writing from 2015 to 2025? (2) What specific keywords and thematic patterns dominate current AWE research in academic writing? (3) What emerging themes and future research opportunities are indicated by the bibliometric mapping of AWE in academic writing? The primary objective of this study is to explore the structural and thematic shifts in the literature, offering an innovative conceptual framework that integrates traditional automated evaluation with modern generative AI capabilities. Theoretically, this study extends the academic writing debate by shifting attention from tool accuracy to global research trends and systemic gaps. Practically, it offers robust empirical evidence that will help policymakers, university educators, and software developers optimize the design and implementation of intelligent writing assistants for diverse academic contexts worldwide.

METHOD

This study employs a quantitative bibliometric research design. Bibliometric analysis is a systematic, quantitative method for examining the body of scientific literature in a given field, enabling researchers to identify publication patterns, measure scholarly output over time, map thematic structures, and trace the intellectual evolution of a discipline (Donthu et al., 2021). Unlike narrative literature reviews, bibliometric analysis operates on large, structured datasets of publication metadata, producing empirically grounded, replicable, and visualizable results (Paul & Criado, 2020).

The data were retrieved from the Scopus database (Elsevier). Scopus was selected as the exclusive data source because it offers broader and more consistent coverage of applied linguistics, language education, and educational technology journals than Web of Science, and its structured export formats are fully compatible with VOSviewer (Baas et al., 2020). Data collection was conducted on February 25, 2026, using the following Boolean search query across Article Title, Abstract, and Keywords fields:

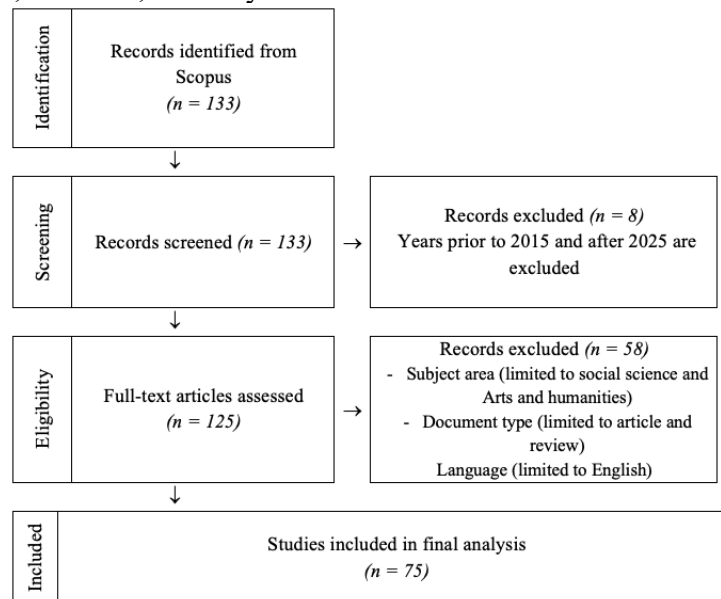


Figure 1. Prisma Flow for Sample Identification

TITLE-ABS-KEY ("automated writing evaluation" AND "academic writing") AND PUBYEAR > 2014 AND PUBYEAR < 2026 AND (LIMIT-TO (SUBJAREA, "SOC")) OR LIMIT-TO (SUBJAREA, "ARTS")) AND (LIMIT-TO (DOCTYPE, "ar") OR LIMIT-TO (DOCTYPE, "re")) AND (LIMIT-TO (LANGUAGE, "English"))

This query yielded 133 records prior to screening. A systematic multi-stage screening process was applied following PRISMA guidelines. After excluding records outside the 2015–2025 timeframe (n = 8), records in irrelevant subject areas (n = 42), non-qualifying document types (n = 11), and non-English publications (n = 5), a final corpus of 75 documents was retained for analysis.

The primary analytical instrument is VOSviewer (version 1.6.20), developed by van Eck and Waltman (2010) at the Centre for Science and Technology Studies, Leiden University. VOSviewer was configured to perform keyword co-occurrence analysis using author-supplied keywords from the 75 included publications. A minimum keyword occurrence threshold of 2 was applied to filter idiosyncratic terms. Data analysis was conducted in five sequential stages: (1) publication trend analysis; (2) keyword co-occurrence analysis; (3) cluster analysis and thematic pattern identification; (4) network analysis; and (5) identification of emerging themes and research opportunities.

RESULT AND DISCUSSION

Results

Publication Trends

This study examines publication trends in AWE research in academic writing from 2015 to 2025. Based on data retrieved from the Scopus database, a total of 75 documents were identified



as meeting the inclusion criteria. Table 1 displays the annual distribution of publications across the ten-year study period.

Table 1. Number of Documents by Year

Year	Documents	Cumulative
2015	1	1
2016	1	2
2017	3	5
2018	4	9
2019	3	12
2020	2	14
2021	4	18
2022	10	28
2023	7	35
2024	18	53
2025	22	75

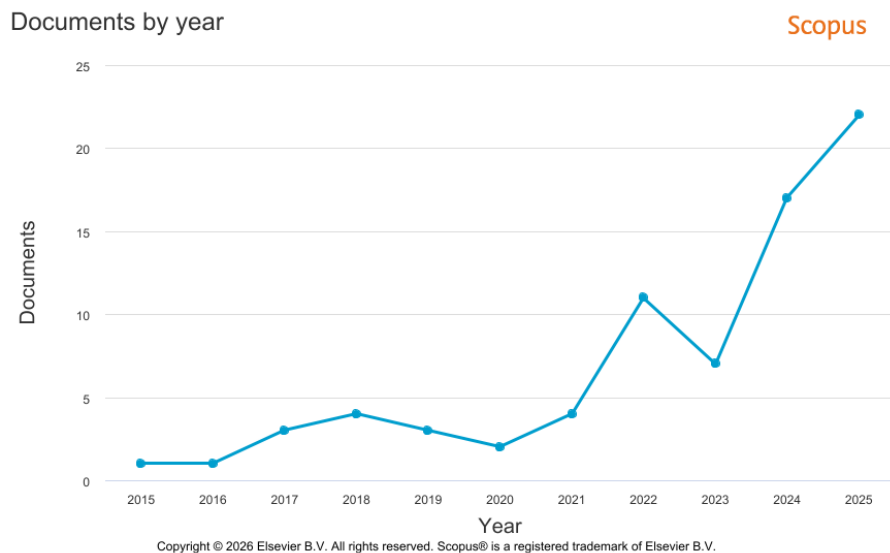


Figure 2. Graphic Document by year from Scopus

A review of the longitudinal data reveals four distinct phases. In the first phase (2015–2017), publication output was minimal, with only one document recorded in both 2015 and 2016, and three in 2017. The second phase (2018–2020) shows gradual, uneven growth, with publications rising to four in 2018 before declining to two in 2020, partly due to the global disruption of the COVID-19 pandemic. The third phase (2021–2022) marks a decisive upturn, with output rising from four documents in 2021 to ten in 2022, corresponding closely with the emergence of powerful generative AI tools and ChatGPT. The fourth and most dynamic phase (2023–2025) represents the sharpest growth, with output surging to 18 in 2024 and reaching 22 in 2025. The cumulative output of 40 documents in 2024–2025 alone accounts for 53.3% of the total corpus, demonstrating that more than half of all publications were produced within the final two years of the study window.

Keywords and Thematic Patterns

To address Research Question 2, keyword co-occurrence analysis was conducted using VOSviewer on the author-supplied keywords from the 75 included publications. With a

highest TLS at 96, confirming its role as the most central hub in the network. Notably, "feedback" achieves a TLS of 38 despite only nine occurrences, indicating it is a transversal concept that cuts across multiple research themes and connects the technology cluster to the pedagogy cluster.

Cluster Analysis and Thematic Patterns

VOSviewer's modularity-based clustering algorithm identified three primary thematic clusters within the keyword co-occurrence network.

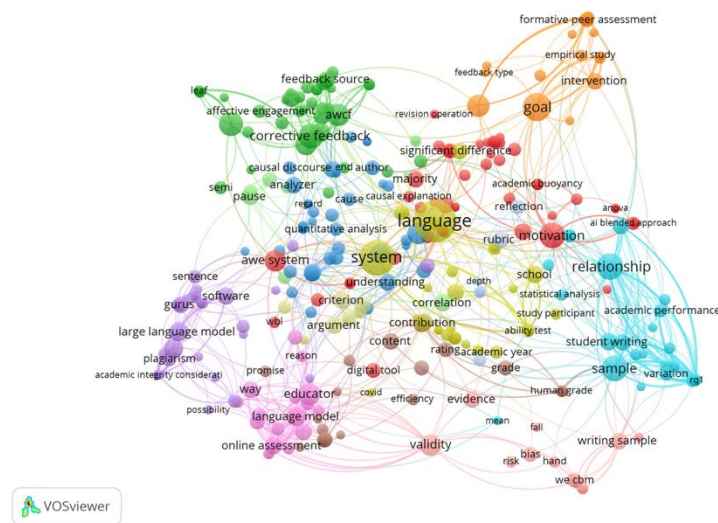


Figure 4. Thematic Pattern Mapping from VOSviewer

Cluster 1: Technology and AI-Driven Evaluation. This cluster encompasses keywords including "artificial intelligence," "natural language processing," "ChatGPT," "large language model," and "automated feedback." It represents the technological substrate of AWE research. The tight clustering of these terms reflects the consolidation of AI-based approaches as the dominant technological paradigm in AWE since approximately 2022. The prominence of ChatGPT within this cluster reflects the field's broader transition from rule-based and statistical AWE models toward generative and conversational AI.

Cluster 2: Feedback, Pedagogy, and Assessment. This cluster groups keywords including "feedback," "writing assessment," "corrective feedback," "Grammarly," "writing instruction," "student engagement," and "teacher feedback." This cluster occupies the pedagogical center of the AWE research landscape. The presence of "teacher feedback" within this cluster suggests that researchers conceptualize AWE not as a replacement for human feedback but as a complementary or comparative tool, positioning AWE within a broader ecology of feedback practices.

Cluster 3: Language Learning and Second Language Writing Contexts. This cluster includes keywords such as "second language writing," "L2 writing," "EFL," "ESL," "academic writing," "writing quality," and "English as a foreign language." Its emergence as a distinct cluster confirms that AWE research in academic writing is predominantly situated within second language (L2) and EFL educational contexts, consistent with the broader AWE literature (Koltovskaia, 2020; Li et al., 2021).

Emerging Themes and Future Research Opportunities

The overlay visualization in VOSviewer, which color-codes nodes by the average publication year, revealed that keywords such as "ChatGPT," "large language model,"



"academic integrity," and "feedback literacy" appeared predominantly in publications from 2022 onward, marking them as the most significant emerging themes. The rapid rise of ChatGPT as a top-frequency keyword within only three years confirms the profound impact of generative AI on AWE scholarship.

Based on these emerging themes, several opportunities for future research are identified. First, further studies are needed to evaluate the effectiveness of AI-generated feedback, particularly when compared to human feedback. Second, future research should explore the ethical implications of using AI in academic writing, including issues related to academic integrity and reliance on automated tools. Third, the long-term impact of AWE tools on writing development needs to be investigated, as most existing studies focus on short-term outcomes. Additionally, future studies could examine AWE applications across different proficiency levels and learning environments, and focus on enhancing the personalization and adaptability of AWE systems.

Discussion

The publication trend of AWE research from 2015 to 2025 shows an initial period of slow growth, followed by a phase of accelerating output that mirrors broader trends in related research fields. The sharp increase from 2022 onward is consistent with Litvinova et al.'s (2024) observation that AI-assisted writing has emerged as one of the most rapidly expanding research clusters in the educational technology literature. The relatively modest total corpus size ($n = 75$) suggests that, while interest in AWE is growing, the specific intersection of AWE and academic writing remains a somewhat specialized sub-field.

The finding that "ChatGPT" ranks as the third most frequent keyword across the 2015–2025 corpus, despite only entering the academic lexicon in late 2022, highlights the rapid impact of generative AI on the conceptual landscape of the field. This is consistent with Ardiana et al.'s (2025) bibliometric analysis of EFL writing assessment, which similarly identified AI and AWE as the fastest-growing thematic clusters in the post-2022 literature. The three-cluster thematic structure also aligns with Barrot's (2023) conceptualization of AWE research as evolving along three parallel but interconnected axes: technological development of the systems, their pedagogical application as feedback tools, and their deployment in L2 educational contexts.

The bibliometric mapping indicates that generative AI, academic integrity, and feedback literacy are the most prominent emerging themes, reflecting a fundamental tension within contemporary AWE scholarship. On one hand, the technological capabilities of AI-powered writing tools have expanded dramatically, offering the potential for more contextually sensitive and personalized feedback (Barrett & Pack, 2023; Eaton et al., 2026; Escalante et al., 2023; Wang, 2024). On the other hand, these same capabilities have introduced unprecedented challenges to the foundational assumptions of academic writing pedagogy — assumptions about authorship, originality, and the developmental purpose of writing tasks. Interpreted through the lens of Vygotsky's sociocultural theory, this tension can be framed as a question of mediation: whether generative AI tools function as scaffolds that expand learners' zones of proximal development, or as replacement mechanisms that bypass the developmental process altogether (Ahlström & Aldenkvist, 2026; McPhee & Jerowsky, 2025; Mohammed & Khalid, 2025; Perkins et al., 2024; Stojanov, 2023; Tran et al., 2025).

From the perspective of activity theory (Engeström, 1987), the bibliometric patterns can be interpreted as evidence of a systemic reconfiguration within academic writing practices. The redistribution of evaluative responsibility from human instructors to automated systems alters



the division of labor within the academic writing activity system. The emergence of academic integrity as a prominent keyword cluster in post-2022 publications is a direct reflection of this systemic tension, as institutions struggle to reconcile the pedagogical potential of AI-powered AWE with the integrity frameworks that academic writing assessment has historically been built upon. A limitation of this study is the relatively small corpus size ($n = 75$), which constrains the statistical robustness of the co-occurrence network. This limitation is partly a consequence of the deliberate focus on the specific intersection of AWE and academic writing. Future studies could consider broadening the search query to include synonymous terms such as "automated essay scoring" or "AI writing tools." Additionally, triangulation with Web of Science or ERIC data could provide a more comprehensive view of the AWE-in-academic-writing research landscape.

CONCLUSION

This study offers a thorough bibliometric mapping of automated writing evaluation (AWE) research in academic writing spanning from 2015 to 2025. The results demonstrate a marked growth in research output, especially following 2022, reflecting the expanding role of artificial intelligence in writing assessment and pedagogy. The study uncovers a fundamental transformation within AWE research, marked by a transition from conventional automated scoring systems toward more sophisticated, AI-powered formative feedback mechanisms. The rise of generative AI technologies, most notably ChatGPT, represents a pivotal turning point that is redefining both the technological potential and pedagogical relevance of AWE. By combining publication trend analysis, keyword co-occurrence, and thematic mapping, this study advances a more structured understanding of the intellectual landscape and emerging directions of AWE research in academic writing. Future researchers are encouraged to explore the effectiveness of AI-generated feedback, address ethical issues related to AWE and AI in academic writing, investigate the long-term impact of AWE tools on students' writing development, and develop AWE systems with enhanced personalization and adaptability to better meet the needs of individual learners.

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