

ADAPTIVE LEARNING INTERVENTIONS IN HIGHER EDUCATION ENGLISH LANGUAGE LEARNING

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Adaptive learning technologies are increasingly becoming more common in higher education settings to support English language learning (ELL). While often associated with subjects such as mathematics and science (cf. Slavuj et al., 2017), their role in language education has received far less attention. This is particularly so in university contexts. This critical review maps the current landscape of adaptive learning for ELL in higher education. The review seeks to answer the question: What are the specific adaptive learning interventions currently used for ELL in higher education settings and how do they impact language acquisition outcomes? To identify relevant literature, five major digital academic databases were searched using the following selection criteria: peer-reviewed journal articles, written in English, and published in the last 10 years. The search criteria settings were adjusted to suit each database. Data were then extracted and coded thematically. Twenty-four studies were included in the final review. These studies spanned AI-driven writing tools, adaptive grammar and vocabulary platforms, and personalized learning dashboards to track learners' progress. The findings suggest that adaptive learning systems show significant promise in enhancing ELL especially in terms of writing support, learner autonomy, and learning engagement. More research is needed to address some of the gaps highlighted and to better understand how adaptive learning technologies can meaningfully support diverse learners in higher education.

Keywords: adaptive learning, English language learning, higher education, artificial intelligence

The rise of artificial intelligence (AI) has reshaped the English language learning (ELL) landscape. Among the various recent technological advancements aimed at focusing on improving academic outcomes, adaptive learning has emerged as an especially promising development. Adaptive learning is distinguished by its capacity to adjust instruction and feedback in real time based on individual learners' needs, learning behaviors, and academic progress (Slavuj et al., 2017). In contrast to traditional learning processes that often follow a fixed and linear structure, adaptive learning offers a personalized educational experience. The system dynamically modifies content, sequencing, learning pace, and feedback to match and suit each learner's unique learning needs.

EdSurge (2016) defined adaptive learning tools as educational technologies that respond to students' interactions in real time, offering tailored support to guide learning paths. These tools gather data about learners' behaviors—such as how they answer questions—before then using this information to adapt the learning experience accordingly. Such systems are student-centred, and the personalization of these educational activities promotes student agency by allowing learners to

more ownership of their learning journeys. EdSurge identified three core components of adaptivity: adaptive content, adaptive feedback, and adaptive sequencing.

The use of adaptive learning is often associated with the use of teaching subjects such as mathematics and science (cf. Slavuj et al., 2017). Its application in the context of ELL particularly in higher education remains relatively underexplored. This review aims to fill that gap by investigating which adaptive learning approaches are currently being implemented in higher education academic settings to support English language learners and enhance their educational experiences.

Method

Research Question

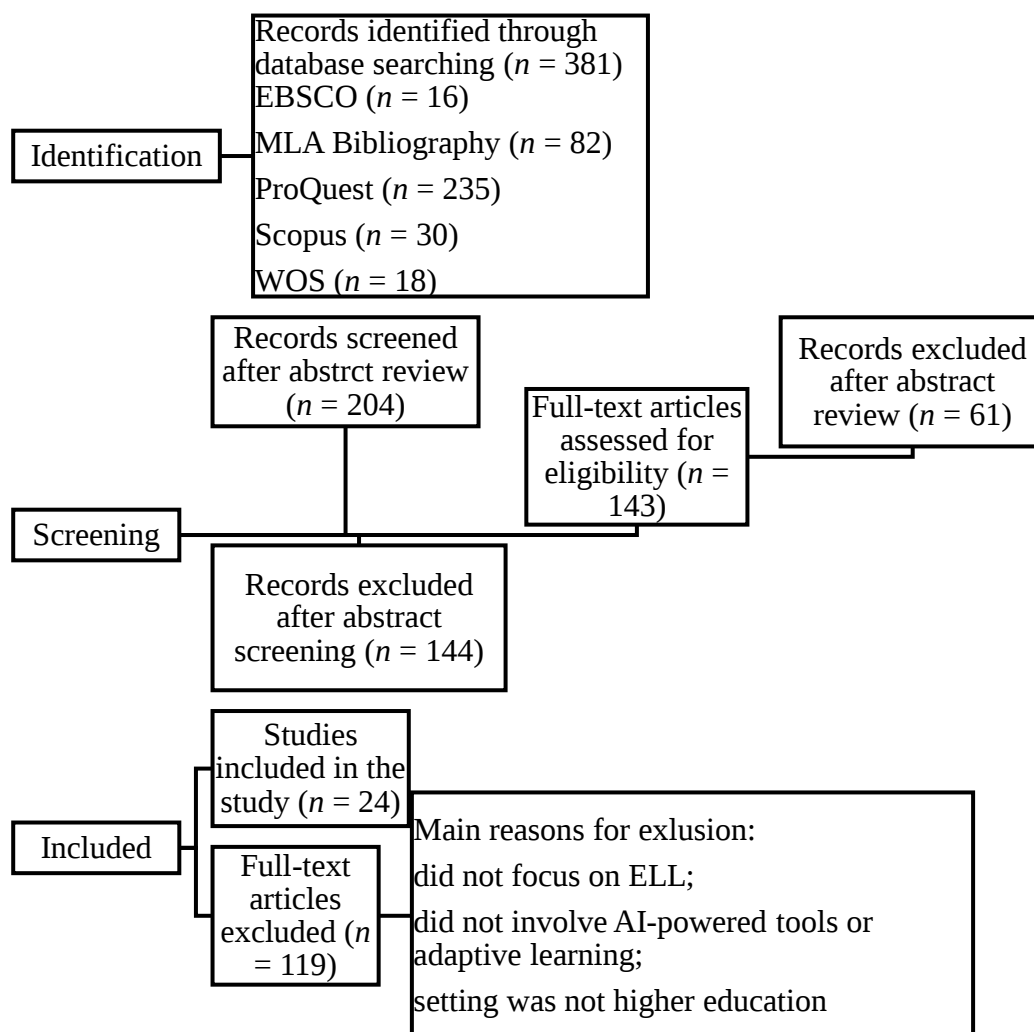
To thoroughly investigate the points previously outlined, the review aimed to provide a more detailed understanding of how ELL can be supported through adaptive learning processes. The guiding research question that this review seeks to answer is the following: What are the specific adaptive learning interventions currently used for ELL in higher education settings and how do they impact language acquisition outcomes?

Identifying Relevant Literature (Search Process)

To identify the targeted literature, five widely used digital academic databases were searched: Education Source (EBSCO), MLA Internal Bibliography, ProQuest Education Database, Scopus, and Web of Science. The search terms were constructed using Boolean logic as follows: (“adaptive learning” OR “AI-powered” OR “automated feedback”) AND (“English writing” OR English language).

Inclusion and Exclusion Criteria

The following selection criteria were set in the search engines: (a) peer-reviewed journal articles, (b) written in English, and (c) published in the last 10 years. As different databases have different ways of setting options, the search criteria settings were adjusted to suit each database. The initial literature search yielded 348 studies. After screening the abstracts, 204 articles were selected for further evaluation of which 143 articles were selected for a full-text review. Ultimately, 24 articles were included in the final analysis while 120 articles were excluded. The main reasons for exclusions were (a) did not focus on ELL, (b) did not involve the use of adaptive learning or AI-powered tool as an intervention, and (c) not conducted in a higher education setting (see Figure 1).

Figure 1*Identification of Studies via Databases*

The papers that were screened and included met these criteria: (a) focused on ELL, (b) involved the use of an AI-powered tool for adaptive learning, and (c) were conducted in a higher education setting.

Instructional Contexts

The instructional contexts in which the studies were situated varied across all the 24 studies. Several studies were situated in English as a foreign language (EFL) environments where learners study English primarily for academic or professional advancement outside English-speaking countries (e.g., Bahari et al., 2024, Barrot, 2023, Polakova & Ivenz, 2024). Other studies were situated in English as a second language (ESL) environments (e.g., Ibrahim & Kirkpatrick, 2024; Ranalli, 2021) while a few examined elective English language programs within higher education

(e.g., Lee, 2020). These differences are important considerations as EFL learners face different institutional demands and linguistic immersions as compared to ESL or academic English learners in different higher education settings.

As the purpose of this literature review was to present a map of the overall landscape of adaptive learning in higher education English language education, studies from all educational instructional contexts were included. However, this breadth does mean that some findings may not be equally generalizable across all settings.

Thematic Synthesis

Among the 24 articles that were included in this review, 17 articles are empirical studies, two articles are case studies, one article is a review, one article is a qualitative study, one article is a developmental study, one article is a technology report, and one article is a systematic review. Figure 1 provides a detailed overview of the search procedure.

To address the research question, the included studies were analyzed across three main dimensions: (a) the types of intervention, (b) the impact of the implementation of the intervention on English language acquisition, and (c) emerging themes and conceptual trends.

A thematic synthesis of the data yielded five main overarching categories. These categories reflect both the types of interventions and broader conceptual concerns addressed across the studies:

- adaptive learning frameworks and systematic overview: studies that focus on mapping, defining, or proposing frameworks for adaptive learning in English language education;
- adaptive writing support systems: interventions that employ automated writing evaluation tools and large language models as writing assistants;
- adaptive multimodal and gamified interventions: systems such as AI chatbots, multimodal platforms, and AI-driven tools that provide speech and pronunciation feedback;
- adaptive recommendation systems and learning ecosystems: studies that focus on platforms that dynamically suggest learning recourse, activities, or pathways based on learner profiles, performances, and preferences; and
- learner perceptions, challenges, and ethical considerations: studies that consolidate learners' and educators' experiences with adaptive tools, and concerns about ethical implications over the use of AI.

Findings

Studies on adaptive learning for ELL describe interventions that utilize automated feedback, chatbots, AI-driven tutoring, and personalized instructions. The following sections present the following: (a) intervention types mentioned in the literature reviewed, (b) the impact of these interventions on learners' English language acquisition, and (c) a thematic discussion of emerging themes from the literature.

Intervention Types

Intervention types included the following:

- AI writing feedback tools (Grammarly, ProWritingAid, Write & Improve, Turnitin, ChatGPT, large language models, Wenxin Yiyan): 13 studies;

- adaptive platforms (including virtual reality [VR], educational technology, massive open online course [MOOC], ALS-KL): five studies;
- reinforcement learning, general regression neural network, machine-learning based recommendation systems: two studies;
- chatbots/conversational agents: one study;
- speech evaluation/speech recognition tools: one study; and
- gamified/multimodal language learning application: one study.

Table 1 presents the intervention type, key features, and adaptation mechanisms that each study employed:

Table 1

Intervention Type, Key Features, and Adaptation Mechanisms

Study	Intervention Type	Key Features	Adaptation Mechanisms
Al-Othman, 2024	Automated feedback system	Cognitive and metacognitive self-regulation in writing	Automated feedback tailored to individual student writing strategies
Ali et al., 2025	AI language tools	Perceptions of learning improvement through tools use	Perceived adaptation via AI responses aligning with learner needs
Bahari et al., 2024	Chatbots, adaptive learning, VR	Proficiency and self-regulated learning development	Learning pathways adapt via chatbot feedback and learner engagement metrics
Barrot, 2023	Automated written corrective feedback	Improved Second Language (L2) writing accuracy	Feedback calibrated to learner errors
EdSurge, 2016	Overview paper (adaptive ecosystem)	Typology of adaptive systems	Theoretical explanation of rule-based and AI-driven adaptations
Gomathi et al., 2024	Reinforcement learning algorithm	Skill acquisition through continuous feedback	Reinforcement algorithm adjusts based on learner performance
Gui et al., 2025	AI writing tools	Engagement in academic writing	AI support tools personalized feedback and suggestions

Ibrahim & Kirkpatrick, 2024	ChatGPT integration	Pedagogical potential for ESL writing	Dynamic text generation and responsive scaffolding
Jaashan & Alashabi, 2025	ChatGPT for spelling	Error correction in EFL writing	AI model detects and corrects learner-specific spelling patterns
Lee, 2020	Automated content feedback system	Adolescent cognitive engagement in writing	Content-based adaptation aligned with learner input
Liaqat et al., 2021	Peer + automated feedback	Mature learner collaboration	Co-designed system tailoring feedback to peer and learner preferences
Link et al., 2024	Genre-based feedback generator	Writing for research publication	Custom genre-aware AI feedback based on text structure
Özçelik & Ekşi, 2024	ChatGPT as writing assistant	Skill development in guided writing	Learner inputs elicit context-aware language support
Polakova & Ivenz, 2024	ChatGPT feedback	EFL writing improvement	Iterative AI feedback adapting to learner responses
Ranalli, 2021	Automated feedback system	Engagement and trust in feedback	Tailored responses based on feedback uptake patterns
Sfenrianto et al., 2018	Adaptive learning system (rule-based)	English learning based on knowledge levels	Content selection based on learner performance diagnostics
Slavuj et al., 2017	Review of adaptive systems	Adaptivity in language learning systems	Conceptual review of multiple adaptation strategies
Taskiran et al., 2022	Automated feedback	Distance EFL writing development	Feedback personalized based on learner submissions
Werdiningsih et al., 2024	ChatGPT usage in writing	Strategy use by master's students	Tools use strategies evolving with learner proficiency

Yang & Zhang, 2025	Machine learning-based personalized recommendation	Learner behavior analysis	Algorithmic tailoring of content to behavior patterns
Yang et al., 2025	AI-driven EdTech (Technique for Order of Preference by Similarity to the Ideal Solution (TOPSIS) model)	Evaluation of AI tools	Optimization of tools features based on ranked criteria
Zarate, 2024	General AI-supported learning	Achievement in tertiary EFL contexts	Unspecified adaptive support mechanisms
Zhang, 2024	MOOC + AI flipped learning	Teacher and student development	Adaptive feedback and AI-driven formative assessment
Zhang & Dong, 2024	Generative AI in ELL	System dynamics and fuzzy-set qualitative comparative analysis (fsQCA) hybrid model	Adaptive scaffolding and systems feedback loops
Zou et al., 2025	AI for speaking practice	Willingness to communicate (WTC)	Interactional adaptation during speaking tasks

Impact of Intervention on English Language Acquisition

Most studies demonstrated positive effects regarding the impact of adaptive learning processes on English language acquisition. This section examines what the measure of outcome was with a focus on the improvement metrics and the success of the implementation of the intervention. Table 2 presents the outcome measure, improvement metrics, implementation context, and success factors that each study measured.

Table 2

Impact of Intervention on English Language Acquisition

Study	Outcome Measure	Improvement Metrics	Implementation Context	Success Factors
Al-Othman, 2024	Self-regulation in writing	Improved strategy use	Case study, higher ed	Feedback tailored to individual strategy levels

Ali et al., 2025	Student beliefs	Perceived improvement	Survey, multiple institutions	Frequent, intuitive AI tools use
Bahari et al., 2024	Language proficiency and self-regulated learning	Statistically significant gains	Experimental study, EFL setting	Multimodal engagement (VR + chatbot)
Barrot, 2023	L2 writing accuracy	Fewer grammatical errors	Writing classrooms	Consistent corrective feedback
Gui et al., 2025	Academic writing engagement	Higher participation and satisfaction	EFL college setting	Ease of use, AI responsiveness
Jaashan & Alashabi, 2025	Spelling accuracy	Reduction in spelling errors	Experimental, EFL learners	Automated correction via LLM
Polakova & Ivenz, 2024	Writing development	Writing score improvements	University-level EFL	Revising behavior triggered by feedback
Özçelik & Ekşi, 2024	Guided writing skills	Improved text structure and cohesion	Writing task sessions, university	Personalized AI language support
Ibrahim & Kirkpatrick, 2024	Pedagogical perceptions	Increased willingness to write	Case study, ESL context	Scaffolded, context-aware content generation
Gomathi et al., 2024	Writing proficiency	Skill acquisition over time	Engineering students, higher ed	Adaptive algorithm learning loop
Lee, 2020	Writing engagement	Higher cognitive involvement	Secondary school classrooms	Real-time feedback on idea development
Liaqat et al., 2021	Peer feedback collaboration	Improved revision quality	Adult learning program	Combined social and AI feedback loops
Link et al., 2024	Research writing performance	Genre-specific accuracy	Academic publication training	Tailored genre-sensitive feedback
Ranalli, 2021	Feedback trust and usage	Sustained uptake behavior	Undergraduate writing program	System reliability and learner control
Sfenrianto et al., 2018	Vocabulary and grammar scores	Diagnostic-driven improvements	Indonesian university	Clear rule-based

Slavuj et al., 2017	Meta-analysis of adaptivity	Qualitative insights across systems	Literature review	adaptation logic Effective typologies of adaptivity
Taskiran et al., 2022	Writing fluency	Enhanced expression in essays	Distance EFL writing program	Timely and iterative feedback
Werdiningsih et al., 2024	Strategic writing behavior	Adaptive strategy improvements	Graduate English for Academic Purposes (EAP) classroom	Evolving tools use based on learner level
Yang & Zhang, 2025	Personalization outcomes	Better content alignment	Intelligent tutoring platform	Behavioral analytics-based feedback
Yang et al., 2025	Evaluation of AI systems	Optimal ranking of features	Tertiary EdTech environment	Feature prioritization by learner needs
Zarate, 2024	English proficiency achievement	Pre/post-test score gains	Mixed tertiary EFL setting	Integrated, holistic AI support
Zhang, 2024	Learning outcomes in AI-MOOC	Enhanced teacher & student scores	Flipped learning environment	Synergy between MOOC and AI feedback
Zhang & Dong, 2024	Learner progression patterns	System-verified achievement indicators	Online adaptive environment	Dynamic scaffolding mechanisms
Zou et al., 2025	WTC and speaking fluency	Higher speech output and confidence	Speaking task-based ESL platform	Real-time conversational AI adaptation

Thematic Discussion

Theme 1: Adaptive Learning Frameworks and Systematic Overviews

Adaptive learning for ELL is commonly utilized in subjects such as mathematics and science. However, four studies out of the 24 presented definitions and theoretical frameworks for adaptive learning in ELL.

Slavuj et al.'s (2017) review of adaptivity in educational systems for language learning provided a foundational typology of adaptive mechanisms used in language learning with a strong

emphasis on adaptive systems that incorporate individualized learning pathways through dynamic system responses. The review identified three groups of adaptation methods in language learning: adaptive sequence, adaptive content, and adaptive feedback. The review mapped and categorized various adaptive learning systems developed from 2005 to 2017 and summarized how these systems can enhance learner motivation and engagement, efficiency of learning paths, and language acquisition outcomes through tailored instruction and reduced cognitive overload. These adaptive systems typically rely on dynamic learner modelling, real-time content adjustment, intelligent tutoring systems, and natural language processing to ensure there is differentiation based on cognitive levels, learning styles, or affective states. This approach ensures that the delivery of such learning experiences respond effectively and efficiently to cognitive and affective learner variables in order to reduce redundancy, enhance motivation, and improve overall language acquisition efficiency. The review mapped the evolving landscape of adaptive interventions and highlighted the need for further empirical validation in higher education settings.

Ibrahim and Kirkpatrick's (2024) meta-analysis complemented Slavuj et al.'s (2017) framework by exploring how studies on ChatGPT can serve as an instructional assistant for L2 writing. Their study explored how generative AI tools such as ChatGPT can enhance writing instruction through automated instructional tasks, offering instantaneous and personalized feedback. These adaptive AI systems are capable of analyzing learner outputs, identifying weaknesses, and adjusting feedback in real time to better support learners' individual writing trajectories. In addition to providing learners with automated feedback, these AI tools can also assist with spelling and provide them with opportunities for regular practice, which has been shown to boost motivation, reduce anxiety levels, and improve learner writing performance. Learners have also reported that these automated feedback are detailed, readable, and consistent as compared to human instructors. What makes ChatGPT especially effective as an adaptive learning tool is the way it is designed to analyze students' performance data, identify areas of weakness, monitor progress, and adjust learning designs as needed to address the specific learning needs of each student. The system demonstrates adaptive features through its dynamic content adjustment, individualized feedback delivery, and learning analytics integration to continuously analyze student performance data. Using this information, ChatGPT can then function as a sophisticated adaptive learning technology to adjust instructional content, difficulty levels, and feedback to match each learner's individual progress and needs. This allows it to move beyond static feedback provision in order to create a responsive educational experience tailored to each individual's learning progress and requirements.

Similarly, Yang et al. (2025) adopted a TOPSIS decision-making framework to assess and optimize various AI-driven English learning tools. The review evaluated several EdTech solutions (e.g., AI feedback systems, adaptive quizzes, language chatbots, etc.) for their effectiveness in enhancing language learning outcomes. The TOPSIS evaluation revealed that these tools significantly improved learners' vocabulary acquisition, sentence construction, and error correction in EFL contexts. These technologies deliver learner-specific content, provide dynamic feedback, and create interactive problem-solving pathways all of which are hallmarks of adaptive learning.

In a related study, Zhang and Dong (2024) further expanded the conceptual scope of adaptive learning. Their study introduced a systems-level perspective through fsQCA and system dynamic modelling to explore the mechanisms by which generative AI like ChatGPT facilitates ELL in higher education. The research utilized fsQCA to examine learner configurations and system dynamics modelling to stimulate the impact of different variables. The study then tracked

how ChatGPT can provide both linguistic feedback and emotional scaffolding. The research revealed that there were high levels of engagement with ChatGPT, positive emotional states, and significantly improved writing quality and learner persistence. ChatGPT's adaptive responsiveness to learner-generated prompts allows for real-time individualized feedback that modulates tone, complexity, and interaction styles and does so by adapting to not only linguistic inputs but also learners' cognitive and emotional states. This integration of behavior tracking, emotional regulation, and personalized instruction exemplifies how adaptive learning operates across content and affective dimensions.

Across these frameworks examined, a common thread they share is the emphasis on adaptive sequencing, feedback, and learner modelling. However, while Slavuj et al. (2017) mapped typologies, Zhang and Dong's (2024) later study emphasized the adaptivity of AI tools through their potential to promote agency, emotional resilience, and long-term language development in tertiary EFL contexts. This shift suggests an evolution from a focus on system design to learner experience, indicating how newer frameworks move beyond structural adaptivity to also consider learner engagement and resilience.

However, these foundational frameworks also reveal methodological inconsistencies that limit their comparative value. Slavuj et al. (2017) provided a comprehensive typological mapping but lacked empirical validation of proposed categories. Ibrahim and Kirpatrick (2024) offered promising meta-analytical insights, but their inclusion criteria seemed to favor positive outcomes that may potentially inflate ChatGPT's perceived effectiveness. Finally, Yang et al. (2025) employed a rigorous TOPSIS methodology, but this application was set without longitudinal validation. Comparing these studies, there is strong theoretical diversity that enriches the conceptual landscape of adaptive learning. However, this also highlights the absence of standardized frameworks for evaluating adaptive learning effectiveness across contexts.

Overall, these conceptual frameworks provide a foundation for more practice-oriented interventions discussed in subsequent themes. They inform some of the design of adaptive writing support systems such as real-time feedback, sequencing, and learner modelling all of which operationalize adaptivity through concrete feedback mechanisms.

Theme 2: Adaptive Writing Support Systems

Adaptive writing support systems are among the most widely implemented adaptive learning interventions in ELL. Some of these tools include automated writing evaluation (AWE) tools as well as ChatGPT and LLM-based writing assistants. These systems leverage natural language processing, machine learning, and learner modelling to provide dynamic and personalized feedback for writing tasks.

AWE Tools and Automated Feedback Mechanisms. AWE tools provide real-time feedback for a learner's writing with a focus on grammar, spelling, syntax, and coherence. Studies such as Al-Othman (2024) and Barrot (2023) reported improvements in learners' writing when they use automated corrective feedback. These studies reflected how real-time contextual feedback increased learners' writing accuracy. Al-Othman's (2024) case study of low-proficient EFL students showed that they benefitted from the use of automated feedback and that these feedback encouraged them to adopt self-regulated writing strategies. These included cognitive self-regulated writing strategies such as language use and writing revision as well as metacognitive self-regulated writing strategies such as idea planning, goal-oriented monitoring, and evaluation of their own writing. The feedback dynamically adjusts to individual writing samples and provides personalized

suggestions tailored to each learner's specific grammatical, structural, and stylistic needs. This not only improved writing accuracy but also fostered critical thinking and reflection. Similarly, Barrot (2023) observed improvements in writing accuracy among EFL students through the use of Grammarly. The tool adapted to individual learners by analyzing their actual language use and providing targeted corrections based on their specific errors. Students noted that these feedback suggestions allowed them to take control of their own learning and gave them greater control over their writing process as they were able to make the decision to accept or reject the corrections. They also shared that these suggestions prompted them to further verify suggestions with their instructors and peers, further promoting agency in their learning.

Further evidence of AWE's effectiveness can be perceived in studies such as Taskiran et al. (2022) and Link et al. (2024) that provided further evidence of AWE's impact on the support it has for writing competence. Taskiran et al. evaluated the use of an AI-based automated feedback tool *Write & Improve* to support distance EFL learners. The tool provides real-time personalized feedback after each draft submission with a focus on grammar, vocabulary, sentences structure, and coherence. *Write & Improve* provides feedback in four types: summative feedback, formative feedback, overall performance feedback, and a progress chart. The study's findings showed a significant improvement in the learners' writing scores between their pre and posttest writing scores, and there was a strong positive correlation between frequency of use and appreciation. Learners also reported high appreciation for the tool's timely self-paced feedback, motivational progress tracking, and enhanced grammar and vocabulary support. The accessibility to feedback anytime promoted a strong sense of self-directed learning in asynchronous environments. Similarly, Link et al. (2024) explored the use of a genre-based learning system *Dissemity* that uses AI-powered automated writing evaluation for English research publication purposes. *Dissemity* provides 3 forms of feedback: (a) automated color coding to represent moves/steps and the argument structure of a manuscript, (b) section-level feedback on the comparison between the user's manuscript and conventions in target disciplines, and (c) sentence-level feedback on the user's communicative intentions at the microlevel. *Dissemity's* context-aware neural network adapts to disciplinary conventions and then uses this information to provide personalized genre-based feedback. Comparative results further showed that the use of *Dissemity* outperformed other existing AI-based tools.

Zhang (2024) further advanced the concept of adaptive AWE through the implementation of the MOOC-based and AI-powered flipped teaching and assessment (MAFTA) of EFL writing model, a MOOC-based and AI-powered flipped teaching and assessment model for EFL writing instruction. The model combines MOOCs, a scenario-based reading-to-write (SBRtW) platform, and *iWrite*, an AI-powered AWE system. Students' postinstruction essays showed significant improvement in their content, organization, and language accuracy. The adaptive nature of the MAFTA model is evident through students' engagement with MOOC content at their own pace, personalized and scaffolded feedback from *iWrite*, and contextualized scaffolding via the SBRtW platform. The integrated ecosystem of AI-driven and learner-responsive tools supports learner agency, iterative learning, and differentiated instruction.

Finally, a hybridized feedback system that integrates both peer and automated writing feedback was proposed by Liaqat et al. (2021) who investigated how such a hybrid system can be tailored to engage mature ELL learners. The intervention demonstrated several adaptive characteristics such as personalized feedback matching to tailor learning content for learners based on their complementary strengths, individualized support that adapts to individual learner differences to provide a personalized scaffolding based on their learner profiles, multimodal

automated feedback for technical language aspects with peer feedback, and progressive skill development through open learner models that contextualize progress by aligning the system's performance to real-world skills. The adaptive feedback delivery, progressive scaffold, and contextualized progress support different social and collaborative dimensions of learning as well.

Collectively, these studies highlight the effectiveness of these adaptive tools in supporting writing development in digitally mediated learning environments and contribute to a deeper understanding of how adaptive interventions affect language acquisition outcomes in higher education contexts. These studies suggest that while AWE tools consistently improve surface-level accuracy such as grammar and spelling, their effectiveness for higher-order skills such as genre awareness or rhetorical development is less defined. Systems like *Dissemity* (Link et al., 2024) show promise in targeting discipline-specific writing while tools such as Grammarly (Barrot, 2023), *Write & Improve* (Taskiran et al., 2022), and *iWrite* (Zhang et al., 2024) remain primarily corrective. Such a comparison indicates that adaptive writing tools are most impactful when tailored to academic contexts rather than when utilized as general correction engines. In addition, studies employing controlled designs (Barrot, 2023; Taskiran et al., 2022) demonstrated clearer evidence of improvement than case studies that rely primarily on learner perceptions (Al-Othman, 2024), which lack quantifiable outcomes. However, these methodological contrasts also illustrate the importance of interpreting findings on writing support systems to be interpreted with caution as AWE tools' effectiveness may be overstated in studies with weaker methodological control.

ChatGPT & LLM-Based Writing Assistants. With the emergence of large language models (LLM) such as ChatGPT, learners are benefitting from these writing “assistants” that enable real-time, individualized writing support. Jaashan and Alashabi (2025) found that EFL learners who used ChatGPT for spelling correction benefitted from trial-and-error learning with immediate corrective feedback. The system delivered a graduated scaffolding that adapts to the individual's learning pace and allow for customized instructions tailored to individual spelling error correction needs. The application monitors students' attempts and adjusts the level of support provided to focus on specific spelling challenges for each learner. Polakova and Ivenz (2024) also reported that iterative engagement with ChatGPT resulted in both quantitative improvements such as grammar and conciseness and qualitative benefits such as error recognition and motivation. The dynamic feedback cycles and responsive feedback to user prompts enabled learners to use the feedback provided to iteratively improve their work, demonstrating strong adaptive learning characteristics. Ibrahim and Kirkpatrick (2024) reinforced these findings in their meta-analysis, highlighting how ChatGPT's automated instructional design, dynamic content adjustment, individualized feedback delivery, and learning analytics integration ensured that each learner receives personalized learning trajectories.

Beyond surface-level corrections, LLM-based tools, particularly ChatGPT, also offer learners not only immediate corrective feedback but also emotional scaffolding and metacognitive partnership. Students in Jaashan and Alashabi's (2025) study also expressed positive attitudes towards using ChatGPT, citing its usefulness for reducing spelling errors and improving writing skills. This is further evidenced by Zhang and Dong (2024) who explored the affective adaptivity of ChatGPT to highlight how high engagement with ChatGPT was associated with improved writing quality, persistence, and positive emotional states. This indicates that adaptive learning systems can also contribute toward emotional scaffolding and motivational regulation. Other studies also highlighted ChatGPT's capacity to support learners beyond surface-level corrections. Werdiningsiha et al. (2024) explored how ChatGPT can also function as a metacognitive partner as postgraduate students employed the tool not simply as a content generator tool but also as a tool

for scaffolding, idea development, genre awareness, and writing revision. This reflects a dialogic and learner-driven interaction, facilitated through strategic prompting and autonomy in their writing process, that further evidences the adaptive qualities of LLMs in supporting a learner's writing process. Özçelik and Ekşi (2024) similarly showed how university students engaged in conversational exchanges with ChatGPT by requesting for targeted corrections and clarifications to practice formal writing styles. The context-aware support that they received boosted their register knowledge acquisition in English writing.

However, ChatGPT research relies heavily on self-reported improvements, which can limit confidence in sustained learning. This is evident in the contradiction between Polakova and Ivenz's (2024) positive quantitative results and Ranalli's (2021) evidence of learner distrust. This could indicate that the effectiveness of such learning tools may depend more on implementation context than the tools design.

Overall, while these adaptive writing support systems primarily focused on text production, the underlying adaptive mechanisms such as dynamic feedback and iterative scaffolding can also extend into multimodal and gamified environments. The third theme below highlights how these can be applied to speech, listening, and immersive learning, which broadens the scope of adaptivity beyond language writing.

Theme 3: Adaptive Multimodal and Gamified Interventions

Several studies explore how tools can be used to combine listening, speaking, VR, chatbots, and multimodal interactions. These include: VR, chatbots, AI tutors, and speech recognition tools.

AI Chatbots, VR, and Multimodal Platforms. AI-powered chatbots, virtual environments, and multimodal platforms can enhance learning algorithms to personalize learning experiences and increase learner engagement. Gomathi et al. (2024) developed an adaptive learning application to provide personalized learning experiences by offering automated feedback for reading, listening, and observational skills. The AI model categorized learners based on their performance and created personalized learning paths tailored to their individual strengths and weaknesses. Reinforcement learning algorithms allowed difficulty levels to adjust and adapt to each learner's progress, providing dynamic learning pathways in real-time to match each learner's progress. Real-time evaluations continuously analyzed students' performances to optimize content delivery and learning outcomes. Zhang (2024) similarly presented an immersive adaptive experience through the MAFTA model, a comprehensive multimodal instructional ecosystem. Within this system, the SBRtW platform used context-rich simulations to guide learners, and virtual tutors and AI agents within the system provided targeted scaffolds based on student interaction. This design enables learners to engage with complex writing genres in adaptive and context-specific environments.

Building on these findings, Bahari et al. (2025) examined the impact of three adaptive interventions on EFL learners' proficiency and self-regulation: a chatbot-based language support, a VR immersion, and adaptive learning algorithms. The study found that the chatbot intervention yielded the most significant improvement in learning outcomes through its real-life simulated scenarios that provided learners with individualized conversation paths, tailored vocabulary, and simulated speaking practices. The platform utilized natural language processing as an adaptive learning algorithm to analyze learners' speech patterns and dynamically adjusted the complexity of the exercises to deliver tailored lessons. The VR immersion complemented this with AI-driven scenarios to cater to the learner's preferences and promote a more learner-centred approach.

Gamification elements such as interactive challenges, mastery progression, and motivational dashboards are also elements that enhance adaptivity in learning environments. Yang et al. (2025) used a TOPSIS multicriteria decision-making model to evaluate AI-based EdTech tools. The evaluation explored how these tools engaged EFL learners and significantly improve their vocabulary acquisition, sentence construction, and error correction abilities. The review noted that tools which incorporated adaptive quizzes, interactive problem-solving pathways, learner-specific content delivery, and real-time dynamic feedback had the most positive impact. A comparison of these multimodal approaches revealed that while VR and chatbot-based systems enhance engagement through immersion and interaction, speech-recognition tools target measurable gains in fluency and pronunciation. Both approaches rely on adaptive algorithms to personalize practice. However, multimodal tools primarily affected motivation and self-regulation while speech-recognition tools delivered tangible improvements in an individual's communicative competence. This suggests that the strength of multimodal adaptivity may lie in affective engagement, and this can complement other systems' linguistic focus. However, it should also be noted that of the six studies in this category, only Bahari et al. (2024) employed experimental controls while others relied on pre/post testing without comparison groups. The overall positive engagement outcomes reported across studies may not be accurate reflections of sustained learning benefits.

AI-Driven Speech and Pronunciation Feedback. Increasingly, speech-based adaptive interventions are gaining more recognition for their role in supporting ELL. These interventions focus on fluency, pronunciation, and WTC. Zou et al. (2025) evaluated the use of *EAP Talk*, an AI-powered English speech evaluation and feedback program with automatic speech recognition. The system assesses students' speech based on automatic speech recognition using comprehensive speech analysis and provides immediate feedback. The system then adapts to the learner's language proficiency and presents appropriate difficulty levels and topics. *EAP Talk* also incorporates virtual human avatars to stimulate lifelike conversations to enhance students' engagement, leading to increased fluency, pronunciation accuracy, and WTC. Similar benefits were observed in Yang and Zhang's (2025) development of a personalized recommendation system for English language learners using a generalized regression neural network (GRNN). The system analyzes multiple aspects of students' learning behavior such as speaking, listening, reading, and writing to recommend targeted learning activities. GRNN captures and learns from nonlinear patterns such as learners' real-time classroom behaviors, historical performance, and preferences. The intervention's integration of such behavioral analytics and dynamic adjustment mechanisms reflects a crucial adaptive learning design that prioritizes linguistic as well as affective learner factors.

Overall, these studies demonstrate that the use of adaptive multimodal and gamified interventions can significantly enhance ELL by supporting both receptive as well as productive skills. Such interventions are very well-suited to support speaking and listening competencies and heighten affective engagement and learner autonomy by creating responsive and engaging learning environments. These systems also depend heavily on algorithms that monitor students' performances and recommend tailored pathways, which are part of a broader adaptive ecosystems theme explored in the next section.

Theme 4: Adaptive Recommendation Systems and Learning Ecosystems

Another important aspect of adaptive learning is the growing emphasis on creating comprehensive and data-driven ecosystems that integrate recommendation engines, learning analytics, and feedback loops. These systems aim to personalize learning through predictive analytics and behavioral tracking that provide learners with holistic and responsive learning environments which monitor and adapt to their learning progress, preferences, and behaviors in real time. These are commonly performed through AI recommendation algorithms (GRNN, machine learning), MOOCs, and platform ecosystems to explore learner perceptions and emotional responses.

Studies such as Yang and Zhang (2025) and Zhang (2024) explored how these systems can function as instructional and affective writing assistants. The use of a GRNN in Yang and Zhang's study drew on multimodal data sources such as posture estimation and engagement tracking to dynamically adapt learning trajectories to align with learners' needs. The inclusion of behavioral and emotional analytics represented a significant advancement in adaptive learning designs and enabled the system to respond to the shifts in a learner's engagement and attention. Zhang (2024) similarly highlighted this trend through a hybrid study of a qualitative comparative analysis (fsQCA) and system dynamics modelling to investigate the correlation between learners' use of generative AI, emotional states, and writing performance. The study found that learners who engaged frequently and strategically with AI exhibited greater persistence and improved writing outcomes. While highly individualized algorithms such as GRNN offer precision tailoring on a smaller scale, MOOC-based or ecosystem models are better able to expand their reaches but at the risk of losing granularity. This trade-off highlights a key institutional dilemma in higher education: the prioritization of personalization over scalability.

In a more application-focused context, Zarate (2024) demonstrated how an AI-mediated instructional platform contributed to notable significant increases in learners' language proficiency. The intervention provided personalized feedback, grammar support, vocabulary enhancement, and writing support, and the findings revealed significant improvement in these aspects of learning. Learners reported an increase in motivation, self-regulated learning, and learning engagement. By adapting to each learner's proficiency levels and offering tailored recommendations and interactive support, these adaptive strategies further supported students' independence in their learning trajectories.

Similarly, both Sfenrianto et al. (2018) and Gomathi et al. (2024) applied a classic adaptive learning model that assigned learners to proficiency bands to ensure appropriate learning content delivery. These studies adjusted English learning materials based on participants' levels of proficiencies via a pretest, and the results were used to tailor and assign customized learning materials that aligned with the learners' proficiency levels. Postintervention findings from both studies affirmed the effectiveness of such individualized progression models in EFL contexts. These studies highlight key features of adaptive learning that include individualized content delivery, continuous assessment, and progression tracking.

Overall, these implementations signal a shift towards adaptive ecosystems designed as responsive learning environments. They are capable of providing learners with comprehensive learning cycles and dynamic scaffolding skill developments and facilitate student autonomy during their learning. These findings illustrate how advanced adaptive systems can effectively address learners' linguistic needs, support learners' cognitive and emotional growth, and be embedded across an entire learning environment. However, their effectiveness is contingent on whether or not learners and educators utilize them. The final theme thus explores how perceptions, challenges,

and ethical considerations shape how adaptive tools are experienced, implemented, and utilized in practice.

Theme 5: Learner Perceptions, Challenges, and Ethical Considerations

When considering adaptive learning, learner perceptions, challenges, and ethical considerations also need to be taken into consideration. Several studies explored students' engagement, motivation, potential overreliance on, and trust in adaptive learning systems as well as issues of equity, critical thinking, and feedback quality. These are aspects that many have highlighted are issues and areas of concerns.

Ali et al. (2025) investigated students' self-perceived improvements through unsupervised use of AI-powered tools such as Grammarly, Duolingo, and ChatGPT that they collectively referred to as AI-assisted Language Applications (AiLAs). While students reported increased motivation and self-directed learning, the study noted that the perceived effectiveness of these tools did not always correlate with clear tangible learning outcomes. The authors stressed the importance of systematic pedagogical integration of these AiLA tools and advocated for structured instructional approaches, interactive scaffold activities, and a strong focus on collaborative learning and adaptive feedback with strong teacher guidance.

Similar concerns were raised by Ranalli (2021) and Gui et al. (2025) who explored challenges such as trust issues, anxiety, and overreliance, which can arise with extensive use of these platforms. Gui et al. echoed concerns about students' self-reported perceptions of increased willingness to participate in language tasks and reduced anxiety in performing writing tasks. However, Gui et al. also noted that these behavioral engagements were tangibly observable in and during the study. Students also expressed strong concerns about overreliance on AI tools, which they felt could potentially hinder their critical thinking development. Ranalli also found that high-proficiency students often distrusted or underutilized feedback provided by Grammarly, the intervention of focus in the study, while low-proficiency students demonstrated overreliance without critical evaluation. There was limited evidence of deep learning, and the study noted that many participants tended to treat the feedback provided as proofreading rather than engage with it as a learning opportunity. The contrast between Ali et al.'s (2025) positive reports of motivation and Ranalli's evidence of distrust highlights the variability of learner responses. In contrast, Werdiningsih et al. (2024) suggested that learning outcomes depend less on the tools utilized and more on whether learners adopt critical and metacognitive stances.

Interestingly, some learners are able to use AI-powered adaptive systems more critically. Werdiningsih et al. (2024) observed that some learners utilized these AI-powered adaptive systems for critical engagement. Werdiningsih et al. revealed that the EFL master's students employed ChatGPT as a metacognitive partner rather than as a mere answer generator. Through iterative prompting, they integrated a critical evaluation of AI output as part of their writing workflow. By treating AI as a writing assistant and partner, learners were able to utilize adaptivity to support and enhance rather than replace their writing and thinking processes. Building on this, Liaqat et al. (2021) also emphasized that adaptive learning systems may be more beneficial for learners who possess strong intrinsic motivation. This suggests that the perceived value of adaptive learning tools is shaped by learner disposition and purpose. This highlights the importance of refining adaptive learning systems' awareness of their users to ensure that these tools are positioned as scaffolds rather than simple shortcuts.

When perceived as a whole, these findings point to the significance of human factors in shaping adaptive learning outcomes. Learners' trust, autonomy, engagement, and self-regulation, are important aspects that must be carefully considered when implementing adaptive interventions. Although adaptive systems have the capacity to dynamically personalize instruction and feedback with great precision, ultimately, their pedagogical value depends on learners' interaction with and interpretation of this content. Ethical considerations such as data privacy, learner dependency, and human oversight also need to be addressed to ensure that adaptive learning contributes meaningfully to ELL in higher education.

Overall, these themes illustrate how adaptive learning in higher education English language contexts can be best understood not as isolated learning tools but as interconnected systems. The frameworks provide a theoretical grounding, the interventions demonstrate the applied potential of these interventions, adaptivity ecosystems scale adaptivity across contexts, and learner perceptions determine how and the extent to which these interventions succeed. This interdependence underscores the importance of integrating technical, pedagogical, and human dimensions that need to be taken into consideration when evaluating the future of adaptive learning.

Discussion

This review examined 24 recent studies that explore the use of adaptive learning interventions in English language education within higher education contexts. The literature reveals a growing and increasingly diverse landscape of adaptive tools from automated writing evaluation systems to chatbots, gamified platforms, and personalized algorithm recommendation platforms. Across these different modalities, these adaptive systems consistently demonstrate their capacity to tailor learning content, provide real-time feedback, and support learner engagement and progression.

The findings from the review indicate that adaptive systems can deliver customized recommendations and tailored learning trajectories based on learner profiles and behavioral analytics (e.g., Yang & Zhang, 2025; Zarate, 2024) to improve writing accuracy through automated and iterative feedback loops (e.g., Al-Othman, 2024; Barrot, 2023); enhance learners' English language skills such as vocabulary, grammar, speaking, listening, and writing (e.g., Gomathi et al., 2024; Zou et al., 2025); foster learner autonomy and agency through metacognitive engagement (e.g., Werdiningsih et al., 2024); and support learners' affective and emotional states through responsive AI interactions during the learning process (e.g., Zhang & Dong, 2024).

Comparing the 24 studies reveals both convergence and divergence in the impact of adaptive learning on language acquisition. Convergence is evident in the consistent benefits reported for surface-level skills such as grammar, vocabulary, and error corrections. These benefits appear across small-scale case studies (e.g., Al-Othman, 2024) to controlled experiments (e.g., Taskiran et al., 2022). Divergence is evident in how robust the findings are. Some studies based on short-term interventions (e.g., Lee, 2020) or self-reported surveys (e.g., Ali et al., 2025) tended to present more optimistic results. However it is also important to note that while such data capture learner perceptions, they may not always provide objective measures of learners' language development. Some studies based on longitudinal or mixed-methods studies (e.g., Zhang & Dong, 2024) raise questions about sustained impact and learner overreliance on feedback. Such a contrast suggests that adaptive learning can be effective at accelerating immediate skill gains, but its long-term influence on complex abilities such as critical thinking, genre awareness, and academic voice, remains underexplored.

Implications

These findings carry several implications for higher education contexts. Firstly, for educators, this review demonstrates that adaptive tools cannot be treated as stand-alone solutions. Adaptive learning strategies have the strongest impact when embedded into structured curricula where feedback is mediated and contextualized by instructors. Secondly, for learners, this review illustrates how adaptive systems can promote autonomy and persistence. However, they can also risk encouraging overreliance and dependence if not paired with training in critical evaluation of feedback. Finally, for institutions, this review highlights the importance of investment in adaptive platforms. These investments should also be guided by both pedagogical goals and infrastructural support. This ensures that systems are not merely deployed as efficiency tools but are effectively integrated into programs that prioritize learning outcomes.

Overall, these adaptive learning systems are not merely about improving discrete language skills but are about reshaping the ecology of language instruction. The effectiveness of the implementation of such adaptive learning systems depend on how they interact with classroom practices, institutional policies, and learner agency rather than isolated technical capacity.

Limitations and Research Gaps

The review also highlights several critical limitations and challenges in the development and implementation of adaptive learning systems for the learning of English language in higher education. The following discussion outlines review limitations, pedagogical and methodological limitations, and identifies a key research gap.

Pedagogical

Firstly, there is a lack of pedagogical integration. Many studies (e.g., Ali et al., 2025; Ranalli, 2021) examined AI-powered adaptive tools used informally or experimentally rather than as part of a structured academic writing instruction. In many cases, teachers' roles were usually peripheral or absent, which limits structured scaffolding and guidance. Additionally, there is an uneven focus across language skills when utilizing these adaptive interventions. There is a heavy emphasis on writing (e.g., Link et al., 2024; Sfenrianto et al., 2018; Taskiran et al., 2022) with few adaptive tools focused on reading, listening, or speaking (e.g., Bahari et al., 2025; Yang & Zhang, 2025; Zou et al., 2025).

Methodological

Secondly, the predominance of small-scale study designs restricts understanding of the sustained impact of adaptive interventions on writing development or language acquisition. Methodologically, many of the studies are short-term interventions or small scale-participants (e.g., Lee, 2020; Ranalli, 2021). This limits the generalizability of the findings and hinders analysis of long-term learning outcomes. Additionally, many studies rely heavily on self-reported perceptions of improvements rather than objective pre and posttests. These points raise questions about the validity of reported gains. In many cases (e.g., Ali et al., 2025; Ranalli, 2021), learners expressed distrust about systems' suggestions or reported an overreliance on the system's suggestions. Some studies also noted concerns about students using AI-tools for correction or

content generation (e.g., Gui et al., 2025; Ibrahim & Kirkpatrick, 2024) that can potentially undermine their critical thinking development.

Furthermore, while many of the included studies report positive effective of adaptive tools, the strength of the evidence varies considerably. The critical review shows that findings based on experimental of mixed-methods designs tend to carry more weight than those relying on surveys or self-reported improvements, which are understandably vulnerable to bias. However, this imbalance may limit the certainty of conclusions to be drawn about long-term efficacy of adaptive interventions.

Ethical and Affective

Finally, discussions of accessibility, equity concerns, ethical concerns, and affective dimensions are limited. Although some studies (e.g., Liaqat et al., 2021; Zhang & Dong, 2024) addressed the emotional impact of adaptive learning tools, there is limited discussion on learner diversity, digital literacy, or bias in these adaptive algorithms. There is thus a crucial need to ensure that adaptive learning trajectories respect these ethical concerns to ensure balanced inclusivity.

There is also an apparent publication bias toward positive outcomes. Of the 24 studies reviewed, only three reported mixed or negative results. This pattern could suggest that there may be unsuccessful adaptive learning implementations that are underrepresented in the literature, inflating perceived effectiveness across intervention types.

Review Limitations

Although this review offers a comprehensive synthesis of adaptive learning interventions in higher education ELL, there are a few limitations to consider. Firstly, the choice of databases (EBSCO, MLA International Bibliography, ProQuest Education, Scopus, and Web of Science) has shaped the scope of the literature retrieved. This may have inevitably excluded other relevant studies published in other databases or grey literature. Secondly, the inclusion criteria (i.e., peer-reviewed journal articles, published in English, and articles published within the last decade) may have privileged certain forms of scholarship while potentially excluding insights from non-English contexts or studies published outside of the listed time frame. Thirdly, there is an uneven distribution of study contexts. These methodological limitations may constrain the reliability of the findings, but they also strongly underscore the need for longitudinal, classroom-integrated research designs.

Finally, the review also did not distinguish between different instructional contexts (e.g., ESL vs. EFL settings, writing vs. speaking-focused interventions), which means that some nuances could have been obscured in the thematic synthesis. The rationale for not separating findings by instructional contexts is mainly because the selected studies were included to provide a broad mapping of adaptive learning in higher education. While contextual differences do shape the design and effectiveness of adaptive learning tools, factors such as the diversity of learner profiles, purposes, and institutional demands may not be directly comparable.

Critical Gap

A notable research gap that has emerged across the 24 studies reviewed is the absence of an adaptive learning system that has been explicitly designed to support the teaching of English

language academic writing to higher education students in a comprehensive and pedagogically integrated manner. In the body of literature reviewed, no existing tools has been developed with a clear focus on pedagogically integrated academic writing instruction at tertiary level. Current systems primarily focus on surface-level language corrections such as grammar, vocabulary, and spelling. Higher-order writing skills such as writing coherence, critical thinking, or genre conventions were briefly investigated (Al-Othman, 2024; Taskiran et al., 2022) but were limited to genre-writing and research publication and did not focus on academic writing development at higher education levels.

Although the literature has shown that tools such as *Grammarly*, *iWrite* and *Write and Improve* are able to offer automated feedback, they function primarily as correction engines and focus only on surface-level writing issues. There is limited focus on rhetorical development, academic voice, or guiding learners through a sustained writing process. Furthermore, many interventions such as ChatGPT or ChatGPT-based tools are utilized in informal or supplementary ways. There is also minimal pedagogical embedding in structured writing curricula.

Notably missing from these studies is an adaptive system that provides scaffolded recursive feedback that goes beyond grammar to support idea generation and genre writing; aligns the adaptive sequence of the system with learning outcomes commonly associated with higher education writing genres and instruction; offers analytical diagnostic insights into students' needs and writing progress at discourse level; and can be pedagogically integrated into different course delivery to enable instructors to monitor, guide, and participate in the feedback loop.

Conclusion

Adaptive learning processes have seen more widespread applications in disciplines such as mathematics and sciences. However, the use of adaptive learning to enhance ELL and English proficiency has received significantly less attention. This review draws attention to this gap. While the current adaptive systems support various aspects of ELL, the current landscape reveals that none are explicitly designed to support academic writing as practiced in higher education. The absence of adaptive systems that accommodate the complexities of academic writing and communication represents a crucial gap that future research must address. There is a pressing need for future research and development to explore building adaptive learning ecosystems that are not only technically responsive but also pedagogically grounded. The potential of adaptive learning to transform and enhance English academic writing education in higher education settings will only be partially realized until such systems exist.

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