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THE COGNITIVE DYNAMICS OF LEXICAL RETRIEVAL IN L2 WRITING: EVALUATING THE ROLE OF AI-GENERATED LEXICAL SCAFFOLDING

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Abstract

Lexical retrieval is among the most cognitively demanding processes in second language (L2) writing, requiring writers to simultaneously manage form-meaning mappings, orthographic encoding, and discourse coherence. This study examined the cognitive and compositional effects of AI-generated lexical scaffolding (AGLS) on 96 Uzbek EFL university students assigned to unaided writing, AI-scaffolded writing, or dictionary-aided writing conditions. Cognitive load was measured via dual-task reaction time, keystroke logging, and retrospective verbal protocols; writing quality was assessed through lexical diversity, accuracy, and sophistication measures. AGLS significantly reduced cognitive load and improved lexical quality outcomes; however, lower-proficiency writers displayed uncritical adoption patterns, raising concerns about lexical agency and long-term vocabulary development.

Keywords

lexical retrieval, L2 writing, AI-generated scaffolding, cognitive load, EFL, vocabulary acquisition

Introduction

Writing in a second language demands the simultaneous coordination of multiple cognitive resources. Among the challenges L2 writers face, lexical retrieval — identifying, accessing, and deploying appropriate words — is particularly significant. Unlike L1 speakers, who retrieve high-frequency items with relative automaticity, L2 writers frequently encounter retrieval failures and form-meaning uncertainty that disrupt composition and deplete working memory resources otherwise available for higher-order planning (Kormos, 2011; Sweller et al., 2019). When retrieval falters, writers resort to circumlocution, semantic approximation, or L1 borrowing — strategies that carry real cognitive and textual costs, especially for

developing writers whose lexical knowledge remains structurally incomplete (Crossley & McNamara, 2012).

The emergence of AI-assisted writing tools has introduced a novel form of lexical support: AI-generated lexical scaffolding (AGLS), comprising real-time synonym alternatives, collocational completions, and contextually appropriate vocabulary options. Theoretical frameworks grounded in Vygotsky's (1978) zone of proximal development and Wood, Bruner, and Ross's (1976) scaffolding construct suggest that well-calibrated external support can extend learner performance while creating conditions for internalization. Yet the distinctive characteristics of AI scaffolding — immediacy, personalization, and opacity — demand dedicated empirical investigation (Warschauer & Grimes, 2008; Ranalli, 2018).

The present study addresses three research questions: (1) Does AGLS reduce cognitive load during lexical retrieval compared to unaided and dictionary-aided writing? (2) Does AGLS improve lexical diversity, accuracy, and sophistication? (3) How do L2 writers of varying proficiency levels engage with AI-generated suggestions during composition? Together, these questions situate AGLS within cognitive-processing and scaffolded-learning frameworks to generate evidence-based insights for researchers, educators, and technology designers.

Literature Review

Research on L2 lexical retrieval has drawn substantially from psycholinguistic models of language production. Schmidt's (1990) noticing hypothesis holds that conscious attention to lexical form is a prerequisite for acquisition, implying that assistance bypassing retrieval effort — as AGLS may do — could facilitate immediate performance while impeding long-term learning. Nation (2001) similarly emphasized the role of productive retrieval practice in consolidating lexical knowledge. This tension between performance facilitation and learning promotion is central to debates about instructional scaffolding in writing contexts.

Cognitive load theory (Sweller et al., 2019) distinguishes intrinsic load (task complexity), extraneous load (poor instructional design), and germane load (schema formation). Lexical retrieval generates high intrinsic load, particularly for novice writers, linked empirically to reduced syntactic complexity, shorter texts, more frequent pausing, and lower writing quality. External lexical aids that reduce intrinsic load may thereby free cognitive resources for planning and argument elaboration. Keystroke logging research corroborates this, showing that L2 writers pause significantly longer at lexical items they know less well, with pause duration inversely correlated with lexical proficiency (Ranalli, 2018).

Research directly examining AGLS during composition remains limited. Studies on automated lexical feedback suggest that targeted, context-sensitive

electronic support can improve lexical choices and promote reflective engagement, though effects depend strongly on learner proficiency (Ranalli, 2018). Research on LLM-based writing assistants confirms improvements in surface-level quality but also raises concerns about authorial agency (Kasneci et al., 2023). A key gap concerns differential AGLS effects across proficiency levels: AI scaffolding systems lack adaptive fading mechanisms and may provide excessive support to stronger writers or contextually inappropriate options for weaker ones, making proficiency-moderated analysis essential.

Methodology

This study employed a convergent parallel mixed-methods design (Creswell & Plano Clark, 2018), integrating quantitative process and product data with qualitative retrospective protocol data. Ninety-six undergraduate EFL students at a state university in Tashkent, Uzbekistan participated. All were native Uzbek speakers with English as a foreign language, stratified across B1, B2, and B2+ proficiency bands (Oxford Quick Placement Test; mean age = 20.4 years, SD = 1.7). Participants were randomly assigned to three conditions (n = 32 each) via blocked randomization.

Conditions and Materials

Participants completed two argumentative writing tasks (250–300 words each) one week apart in a controlled computer laboratory under one of three conditions: (1) Unaided Writing (UW) — no external resources; (2) AI-Scaffolded Writing (AGLS) — a custom browser interface integrated with a large language model (GPT-4-turbo) offering three to five context-sensitive lexical suggestions when the writer paused for more than two seconds; or (3) Dictionary-Aided Writing (DA) — access to an offline bilingual Uzbek–English and monolingual English dictionary. The AGLS system was restricted to lexical suggestions to isolate scaffolding effects at the word level.

Measures and Analysis

Cognitive load was operationalized via dual-task reaction time (auditory tone response during writing), keystroke logging (Inputlog 8.0) capturing pause duration and revision behavior, and 10-minute retrospective verbal protocols. Writing quality was assessed using vocd-D (lexical diversity), error-free lexical unit proportion (accuracy; inter-rater $\kappa = 0.87$), Lexical Frequency Profile (sophistication), and a holistic 1–6 CEFR-calibrated rubric. Quantitative data were analyzed using one-way ANOVA with Tukey's HSD post-hoc tests and Cohen's d effect sizes; keystroke data used linear mixed-effects models; verbal protocol data underwent directed content analysis.

Discussion

The findings provide substantial empirical support for the proposition that AGLS reduces cognitive load during L2 lexical retrieval. The magnitude of reduction — reflected in dual-task reaction times, pause durations, and extended-pause frequency — exceeded that of the dictionary-aided condition, consistent with a large composite effect size. This aligns with cognitive load theory predictions that tools reducing the lexical search component should free working memory for higher-order writing processes (Sweller et al., 2019). The immediacy and contextual tailoring of AI suggestions appear to lower the meta-cognitive cost of tool consultation itself, offering an advantage over conventional reference tools.

These cognitive gains translated into observable textual benefits: AGLS writers produced more lexically diverse, accurate, and sophisticated texts. Critically, lexical diversity gains coincided with error reductions, suggesting AGLS functioned primarily as a retrieval cue — priming partially activated vocabulary — rather than generating unfamiliar items. This interpretation supports a facilitative rather than substitutive role for AI scaffolding in L2 composition.

However, proficiency-moderated findings introduce important qualifications. Lower-proficiency writers showed a pattern of uncritical suggestion adoption, accepting contextually inappropriate items without meaning negotiation — a form of 'scaffolded dependency' that improves immediate output without building durable form-meaning mappings essential for vocabulary acquisition (Ranalli, 2018). Higher-proficiency writers, by contrast, demonstrated selective, evaluative engagement reminiscent of the competent scaffolding recipient described by Wood et al. (1976), integrating suggestions while retaining authorial judgment.

These findings suggest that AGLS benefits are substantially contingent on metacognitive capacity. Optimal AGLS design should therefore incorporate adaptive difficulty calibration and expose the reasoning behind suggestions, transforming the tool into a transparent lexical model rather than a passive vocabulary dispenser. Pedagogically, explicit instruction in evaluative engagement with AI suggestions — akin to critical technology literacy (Warschauer & Grimes, 2008) — appears essential to maximizing learning benefit and mitigating dependency risks.

Conclusion

This study demonstrated that AGLS significantly reduces cognitive load during L2 lexical retrieval and improves lexical diversity, accuracy, and sophistication, with benefits most pronounced among writers who engage evaluatively with suggestions. Lower-proficiency writers' passive adoption patterns, however, highlight the risk of scaffolded dependency and the importance of proficiency-calibrated, pedagogically guided AI integration. Future research

should investigate AGLS transparency effects, adaptive scaffolding intensity, and longitudinal vocabulary acquisition outcomes to develop a comprehensive model of AI-assisted L2 writing cognition.

REFERENCES:

Creswell, J. W., & Plano Clark, V. L. (2018). Designing and conducting mixed methods research (3rd ed.). SAGE Publications.

Crossley, S. A., & McNamara, D. S. (2012). Predicting second language writing proficiency: The roles of cohesion and linguistic sophistication. Journal of Research in Reading, 35(2), 115–135.

Kasneci, E., Sessler, K., Küchemann, S., Bannert, M., & Kasneci, G. (2023). ChatGPT for good? On opportunities and challenges of large language models for education. Learning and Individual Differences, 103, 102274.

Kormos, J. (2011). Speech production and the bilingual lexicon. In A. Pavlenko (Ed.), Thinking and speaking in two languages (pp. 9–44). Multilingual Matters.

Nation, I. S. P. (2001). Learning vocabulary in another language. Cambridge University Press.

Ranalli, J. (2018). Automated written corrective feedback: How well can students make use of it? ELT Journal, 72(1), 42–51.

Sweller, J., van Merriënboer, J. J. G., & Paas, F. (2019). Cognitive architecture and instructional design: 20 years on. Educational Psychology Review, 31(2), 261–292.

Warschauer, M., & Grimes, D. (2008). Automated writing assessment in the classroom. Pedagogies: An International Journal, 3(1), 22–36.

Wood, D., Bruner, J. S., & Ross, G. (1976). The role of tutoring in problem solving. Journal of Child Psychology and Psychiatry, 17(2), 89–100.