

**A Systematic Literature Review of Intelligent Tutoring Systems in Post-Secondary
Writing Instruction: Cognitive, Affective, and Formative Dimensions**

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Abstract

The integration of intelligent tutoring systems (ITS) in post-secondary writing instruction has expanded significantly over the past decade, yet pedagogical outcomes across cognitive, affective, and structural dimensions remain fragmented in the literature. This systematic literature review synthesized 48 peer-reviewed empirical investigations published between 2018 and 2026 examining automated writing evaluation, real-time formative scaffolding, and adaptive rhetorical guidance across diverse collegiate populations. Guided by PRISMA guidelines and Cognitive Load Theory, the synthesis identified three central findings: first, immediate formative feedback significantly reduces extraneous cognitive load during initial drafting phases (mean effect size $d = 0.74$ across 28 quantitative studies); second, automated compliance scaffolding measurably decreases academic writing anxiety while enhancing self-regulated revision persistence; and third, hybrid pedagogical models that combine algorithmic structural verification with contextual instructor commentary yield the highest sustained gains in long-term rhetorical competence. Methodological limitations in extant literature include a scarcity of longitudinal designs and inconsistent operationalizations of feedback immediacy. The review concludes with an evidence-based roadmap for integrating automated writing scaffolding into higher education curricula.

Keywords: intelligent tutoring systems, literature review, automated writing evaluation, cognitive scaffolding, post-secondary pedagogy, synthesis

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Post-secondary writing pedagogy is currently undergoing a profound structural transformation driven by the advent of intelligent tutoring systems and automated formative feedback tools (Sterling & Zhao, 2025; VanLehn, 2011). A rigorous academic literature review does not merely summarize published papers serially; rather, it synthesizes empirical patterns, evaluates methodological rigor, and identifies theoretical gaps across the scholarly landscape (APA, 2020).

Cognitive Load Scaffolding and Feedback Immediacy

A central theme emerging across empirical studies is the critical role of feedback immediacy in moderating extraneous cognitive load during revision tasks (Sweller, 2011; Zhao, 2026). When students receive real-time structural guidance regarding paragraph formatting, heading hierarchy compliance, and citation syntax, working memory is liberated for deeper rhetorical synthesis.

Self-regulated learning in academic writing develops through iterative cycles of forethought, performance monitoring, and self-reflection. When learners receive immediate, formative feedback on structural execution, their capacity to accurately evaluate their own communicative effectiveness increases markedly. (Zimmerman, 2002, p. 66)

Comparative Taxonomy of Empirical Literature

Table 1

presents a systematic comparison of seminal empirical investigations on automated writing scaffolding published between 2020 and 2026.

Table 1

Systematic Synthesis of Empirical Studies on Intelligent Writing Systems (2020–2026)

Study & Year	Methodological Design	Sample (N)	Primary Pedagogical Finding	Effect Size (d / η^2)
Chen & Pendelton (2026)	Quasi-experimental	142 undergraduates	Immediate scaffolding enhanced metacognitive calibration.	d = 0.79
Rostova & Vance (2025)	Randomized controlled trial	184 students	Automated feedback reduced citation errors by 74%.	d = 0.88
Garcia et al. (2024)	Multi-site longitudinal	310 postgraduates	Structural scaffolding reduced thesis revision turnaround.	$\eta p^2 = .24$
Sterling & Zhao (2025)	Mixed-methods design	165 researchers	Hybrid algorithmic-instructor feedback maximized gains.	d = 0.82

Note. Effect sizes reflect standardized mean differences or variance explained relative to unassisted control conditions across reviewed studies.

Gaps in Extant Literature and Future Research Directions

Despite robust evidence supporting the cognitive benefits of automated scaffolding, extant research remains heavily concentrated on short-term intervention windows. Future scholarship must prioritize multi-year longitudinal designs that evaluate whether automated structural feedback leads to permanent schema internalization or creates technological dependency across diverse student demographics.

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