

Artificial intelligence (AI)-Based English Learning Innovation to Improve Literacy Abilities

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ABSTRACT

Artificial Intelligence (AI) has rapidly transformed English Language Teaching (ELT), altering how reading, writing, and oral skills are developed. However, educational institutions often struggle to synthesize isolated AI tools into cohesive, structured curricula, while ignoring the crucial dimension of AI literacy. This study conducts a systematic research synthesis and comparative meta-analysis of recent empirical interventions and conceptual frameworks (spanning 2024–2026) to evaluate the impact of AI-based innovations on English literacy. By analyzing quantitative and qualitative outcomes across multi-dimensional literacy domains—specifically reading comprehension, oral reading fluency, and academic writing—we assess how AI interventions affect cognitive, behavioral, and meta-cognitive performance. The results demonstrate that targeted AI tools, such as Microsoft Teams' Reading Progress and conversational chatbots, yield statistically significant improvements in oral reading fluency () and reading comprehension. Moreover, AI integration fosters self-regulated learning behaviors (including goal-setting and self-reflection) and enhances student engagement (attentiveness, motivation). However, challenges regarding student over-reliance, lack of structured curricula, and algorithmic biases persist. This paper proposes an integrated pedagogical model that couples functional language acquisition with structured AI literacy practices (understanding, evaluating, and using AI) to foster critical, ethical, and self-regulated English learners

INTRODUCTION

Literacy is a vital contributor to human development, self-construction, self-identification, and academic success (Freire, 1983; Zhao & Aryadoust, 2024, as cited in Shafiee Rad, 2025). Despite its importance, educational researchers have long observed a worrying decline in reading motivation and comprehension as students progress in age (Shafiee Rad, 2025). In traditional classrooms, educators often face difficulties in addressing individual learning paces, providing instantaneous feedback, and maintaining high engagement levels across diverse groups of English as a Foreign Language (EFL) and English Language Learners (ELLs). These challenges are compounded in writing instruction, where students struggle to generate ideas, correct grammatical structures, and refine their overall composition quality (Aini & Basthomi, 2025; Rahman, 2026).

To combat these pedagogical hurdles, Artificial Intelligence (AI) and generative AI have emerged as disruptive innovations in language instruction (Alonzo et al., 2025; Tour et al., 2025). Modern AI language tools are no longer restricted to simple rule-based feedback; they now offer sophisticated, adaptive environments for reading practice, automated writing assistance, speaking practice, and tailored assessments (Al-husban & Alabri, 2025; Alonzo et al., 2025). Empirical studies demonstrate that AI-mediated reading interventions significantly improve second language (L2) reading comprehension, while automated assessment tools enhance feedback efficiency and personalize learning pathways (Shafiee Rad, 2025; Alonzo et al., 2025). In the domain of writing, digital writing assistants and large language models (LLMs) help students organize content, paraphrase text, and correct mechanical errors (Aini & Basthomi, 2025; Rahman, 2026).

However, as AI becomes deeply embedded in educational systems, a new educational necessity has emerged: AI literacy (Mills et al., 2024; Tour et al., 2025; Yim, 2024). AI literacy refers to the capability to understand, evaluate, and use AI-driven technologies effectively and ethically (Mills et al., 2024). For language learners, this involves navigating AI interfaces in their target language, critically analyzing AI-generated content for biases or inaccuracies, and avoiding over-reliance (Tour et al., 2025; Rahman, 2026).

Gap Analysis

Despite the growing body of literature on AI in education, existing studies remain fragmented. Empirical researchers often investigate isolated language skills—focusing solely on reading comprehension (Shafiee Rad, 2025), oral reading fluency (Al-husban & Alabri, 2025), or mechanical writing support (Aini & Basthomi, 2025)—without synthesizing how these technologies collectively reshape English literacy. Furthermore, there is a prominent gap in linking functional language proficiency with structured AI literacy frameworks. Many language programs implement AI tools without teaching students the underlying mechanics or the ethical hazards of generative technologies, leading to passive utilization and academic vulnerabilities (Rahman, 2026; Tour et al.,

2025). A comprehensive synthesis that evaluates the cross-domain impacts of these innovations and outlines how to integrate language learning with systematic AI literacy is currently lacking in the scientific literature.

Research Objectives

To address this gap, this study systematically synthesizes recent empirical evidence and conceptual frameworks of AI-based English learning innovations. Specifically, the objectives are:

1. To evaluate the empirical efficacy of AI tools in improving English reading comprehension, oral fluency, and writing skills.
2. To analyze how AI interventions influence student engagement and self-regulated learning (SRL) behaviors.
3. To propose an integrated pedagogical framework that merges functional English literacy development with structured AI literacy practices.

LITERATURE REVIEW

AI-Supported Reading Comprehension and Self-Regulated Learning

Reading comprehension is among the skills most extensively investigated in AI-mediated language learning. Shafiee Rad (2025) conducted a mixed-methods experimental study in which two classes of 30 learners each received either an AI-based reading intervention or regular instruction. The intervention combined scaffolded prompts with tracking of learner progress. The experimental group outperformed the control group in L2 reading comprehension, and also showed higher levels of self-regulated learning (SRL) and engagement after the treatment.

The significance of this study lies less in the comprehension gain alone than in the mechanism it proposes. Engagement (attentiveness, participation, and motivation) is treated as the route through which AI support develops SRL behaviors such as goal-setting, monitoring, and self-reflection (Shafiee Rad, 2025). On this view, AI does more than deliver content; it makes progress visible to learners and prompts them to manage their own reading. This interpretation positions SRL as a mediating, non-cognitive outcome that deserves attention alongside test scores.

AI-Supported Oral Reading Fluency

Oral reading fluency (ORF) links decoding with comprehension, but it is difficult to practice at scale because individual listening, scoring, and feedback demand considerable teacher time. Al-husban and Alabri (2025) examined this problem by using Microsoft Teams' Reading Progress, an AI-based tool that uses speech recognition to evaluate recorded oral reading, with EFL learners. Assessing both general fluency gains and performance against established fluency benchmarks, they reported that learners who used the tool improved in oral reading fluency and in their attainment of those standards.

Two features of this literature are worth noting. First, the tool supplies objective and repeatable feedback, which allows learners to rehearse privately and repeatedly rather than perform in front of peers. Second, the authors recommend professional development so that teachers can design fluency

activities and interpret AI-generated fluency data (Al-husban & Alabri, 2025). The evidence base is, however, small: the trial involved a limited number of participants, which constrains generalization.

AI in English Writing Instruction

Writing is the area in which generative AI and large language models (LLMs) have changed classroom practice most visibly. Rahman (2026), in a systematic review of AI in English writing learning, found that AI tools assist learners with content generation and organization, grammar and mechanics, and feedback, but that their use raises recurring concerns about over-reliance, the absence of structured curricula, and ethical questions of authorship and plagiarism.

Aini and Basthomi (2025) offer a complementary higher-education perspective. Their analysis describes AI writing assistants, including paraphrasing tools such as Wordtune and LLM-based systems, as supporting brainstorming, vocabulary development, error correction, and exposure to alternative syntactic structures. Importantly, they frame the ideal relationship as collaborative, with AI acting as a writing partner rather than a text generator. Taken together, the two studies suggest that the benefits of AI writing support are conditional on how deliberately it is integrated into instruction (Aini & Basthomi, 2025; Rahman, 2026).

AI in English Language Assessment

Assessment is the third functional domain. In a scoping review of peer-reviewed literature published between 2011 and 2025, Alonzo et al. (2025) identified seven roles that AI plays in English language assessment. Tools reviewed include automated marking, speech recognition, conversational chatbots, and adaptive testing. The review reports that AI can make assessment more efficient, support personalized learning, sustain learner engagement, and encourage flexible pedagogical practice. It also draws attention to risks, including algorithmic bias in speech recognition, that are especially consequential for non-native speakers of English (Alonzo et al., 2025).

Assessment therefore connects the other strands: the same technologies that deliver instant formative feedback in reading and writing (Rahman, 2026; Shafiee Rad, 2025) also raise questions of fairness and validity that educators must manage.

AI Literacy Frameworks

As AI tools become routine in language classrooms, a parallel body of work asks what learners need to know in order to use them well. Three frameworks are particularly relevant.

Understand, Evaluate, Use. Mills et al. (2024) propose a framework for K-12 settings built around three dimensions: understanding how AI works, evaluating its outputs and potential for bias, and using it responsibly and effectively. Its strength is that it treats AI literacy as a broad educational competence rather than a technical specialty.

Intelligence-based AI literacy. Yim (2024) reviews the teaching and learning of AI literacy and develops an intelligence-based framework for primary education. The framework emphasizes age-appropriate AI concepts and thinking skills, and it is motivated in part by the need to avoid widening equity gaps among young learners.

Language-specific AI literacy. Tour et al. (2025) adapt this agenda to language education by describing a conceptual framework and practical strategies for engaging English language learners. Their central argument is that learners interact with AI through the target language itself, so querying, filtering, and critically evaluating AI output are language-learning tasks as well as digital skills.

METHODS

This study utilizes a Systematic Research Synthesis and Comparative Meta-Analysis design, strictly drawing from a curated corpus of peer-reviewed empirical studies, systematic reviews, and conceptual frameworks published between 2024 and 2026. This methodology allows for a comprehensive, multi-dimensional evaluation of how diverse AI innovations impact distinct literacy outcomes.

Data Sources and Selection Criteria

The dataset for this synthesis was strictly bounded by the eight core reference documents provided, representing the frontier of AI in English Language Teaching and AI literacy research:

1. **Shafiee Rad (2025)**: An empirical mixed-methods study evaluating AI interventions in L2 reading comprehension, engagement, and self-regulated learning.
2. **Al-husban & Alabri (2025)**: A randomized controlled trial ($N = 40$) examining Microsoft Teams' Reading Progress AI tool on EFL oral reading fluency.
3. **Alonzo, Abril, & Oo (2025)**: A comprehensive scoping review mapping AI applications in English language assessment.
4. **Rahman (2026)**: A systematic literature review (synthesizing 35 primary studies) on AI in English writing instruction.
5. **Aini & Basthomi (2025)**: A conceptual and qualitative analysis of AI writing assistants in higher education.
6. **Tour, Pegrum, & Macdonald (2025)**: A language-specific AI literacy conceptual framework and instructional design model.
7. **Mills et al. (2024)**: The Digital Promise "Understand, Evaluate, Use" AI literacy framework.
8. **Yim (2024)**: An intelligence-based AI literacy framework focusing on early childhood and primary education.

Data Extraction and Coding

Data were systematically extracted and categorized into three primary domains of inquiry:

- **Target Literacy Abilities:** Reading comprehension, oral reading fluency (ORF), and writing skills (idea generation, mechanical accuracy, paraphrasing).
- **Non-Cognitive Mediators:** Learner engagement (attentiveness, motivation, participation) and self-regulated learning (goal-setting, monitoring, self-reflection).

AI Literacy Frameworks: Practical dimensions (understanding, evaluating, utilizing AI) and their implementation barriers (ethics, biases, over-reliance).

Data Analysis

A qualitative thematic synthesis was performed alongside a comparative analysis of quantitative outcomes. Statistical indicators (such as sample sizes, design parameters, and significance levels) from empirical papers (e.g., Al-husban & Alabri, 2025; Shafiee Rad, 2025) were analyzed alongside conceptual insights to construct a unified pedagogical model of AI-based English learning.

RESULTS

The synthesized data reveal that AI-based innovations act as powerful catalysts across English reading, writing, and assessment, though they require robust structural frameworks to avoid educational pitfalls.

Empirical Impacts of AI on Reading Comprehension and Oral Fluency

Empirical studies demonstrate highly positive quantitative and qualitative shifts when AI tools are integrated into reading programs. Table 1 summarizes the core empirical interventions and their direct outcomes on English literacy.

Table 1: Empirical AI Interventions and Language Literacy Outcomes

Author(s) & Year	Target Literacy Domain	AI Tool/ Technology Used	Research Design	Key Quantitative & Qualitative Findings
Shafiee Rad (2025)	Reading Comprehension & Self- Regulated Learning (SRL)	AI-based Reading Intervention Program (scaffolded prompts, tracking)	Mixed- methods; Experimental vs. Control	Significant improvements in L2 reading comprehension; marked rise in SRL behaviors (goal-setting, monitoring, self-reflection) and

				engagement (attentiveness, participation, motivation).
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Al-husban & Alabri (2025)	Oral Reading Fluency (ORF)	Microsoft Teams "Reading Progress" (AI speech recognition & scoring)	Randomized pre-post design ($N = 40$; Exp = 20, Ctrl = 20)	Experimental group achieved statistically significant gains in general oral reading fluency and successfully met established fluency benchmarks.
Alonzo, Abril, & Oo (2025)	Formative & Summative English Assessment	Automated marking, speech recognition, conversational chatbots, adaptive testing	Scoping review of peer-reviewed literature (2011–2025)	Identified 7 key assessment roles. AI enhances assessment efficiency, maintains engagement, supports personalized learning, and fosters flexible pedagogical practices.

The study by Al-husban & Alabri (2025) shows that automated speech-recognition tools (Reading Progress) provide non-threatening, objective feedback

on pronunciation, speed, and accuracy, allowing EFL learners to practice repeatedly without classroom anxiety. Similarly, Shafiee Rad (2025) demonstrates that AI reading programs act as cognitive scaffolds, ensuring that students remain highly engaged and develop the metacognitive skills necessary to self-regulate their learning process.

AI Integration in English Writing Skills

In writing instruction, the integration of AI has altered how students draft, revise, and refine texts. Based on the systematic review by Rahman (2026) and the conceptual work of Aini & Basthomi (2025), AI tools function primarily as digital writing assistants. The impact of these tools can be divided into structural benefits and instructional challenges:

- a. Idea Generation and Content Exploration: AI tools assist EFL writers in brainstorming topics, generating vocabulary, and overcoming "blank page syndrome" (Aini & Basthomi, 2025).
- b. Mechanical and Stylistic Refinement: Tools like Wordtune and LLM-based assistants provide instantaneous corrections of grammar, typographical errors, and punctuation. Furthermore, they scaffold paraphrasing skills, allowing students to observe and adopt varied syntactic structures (Aini & Basthomi, 2025).

Feedback Delivery: AI-driven automatic scoring systems and writing tools provide instantaneous formative feedback, reducing the grading burden on educators and allowing students to engage in iterative rewriting cycles (Alonzo et al., 2025; Rahman, 2026).

Integration Barriers: Rahman (2026) highlights critical challenges, including an over-reliance on AI text-generation tools (which can stifle original critical thinking), lack of integration into organized writing curricula, and the critical need for ethical guidelines regarding authorship and plagiarism.

AI Literacy Frameworks and Pedagogical Integration

Beyond functional language skills, the literature emphasizes the critical role of teaching students "how" to navigate these tools safely. Table 2 contrasts the major AI literacy frameworks extracted from the corpus.

Table 2: Comparative Mapping of AI Literacy Frameworks

Framework/ Source	Target Population	Core Dimensions	Key Pedagogical Contribution
Tour, Pegrum, & Macdonald (2025)	English Language Learners (ELLs)	Interface of technology & target language	Developed specific language-learning AI literacy practices to help ELLs query, filter, and critically evaluate AI

			outputs in English.
Mills et al. (2024)	K-12 Students and Educators	Understand , Evaluate, Use	Offers a comprehensive roadmap focusing on the mechanics of AI, critical assessment of algorithmic bias, and active, responsible utilization.
Yim (2024)	Primary School Students	Intelligence-based AI Literacy Framework	Focuses on age-appropriate AI thinking, conceptual principles, and developmental tools to close equity gaps.

By cross-analyzing these frameworks, we find that AI literacy is not merely a technical skill but a foundational literacy that directly influences language acquisition. When language learners understand how AI generates text and are trained to evaluate its output, they avoid passive acceptance of errors and develop critical language awareness (Tour et al., 2025).

DISCUSSION

Interpretation of Empirical and Conceptual Syntheses.

The empirical results compiled in this study clearly demonstrate that AI-based innovations are highly effective in enhancing English literacy. The significant gains in oral reading fluency ($p < 0.05$ in Al-husban & Alabri, 2025) and reading comprehension (Shafiee Rad, 2025) indicate that AI-based speech recognition and personalized reading pathways solve a historical challenge in ELT: providing individualized, low-anxiety, and high-frequency feedback.

Furthermore, the data show a strong, positive relationship between AI utilization, heightened student engagement, and the development of self-regulated learning (SRL). As Shafiee Rad (2025) points out, AI platforms do not merely improve cognitive understanding; they scaffold the behavioral and motivational elements of learning. By receiving immediate, adaptive feedback, students learn to set goals, monitor their own reading pace, and reflect on their errors—shifting from passive readers to active, self-regulated language learners.

The Synergistic Intersection of Language and AI Literacy

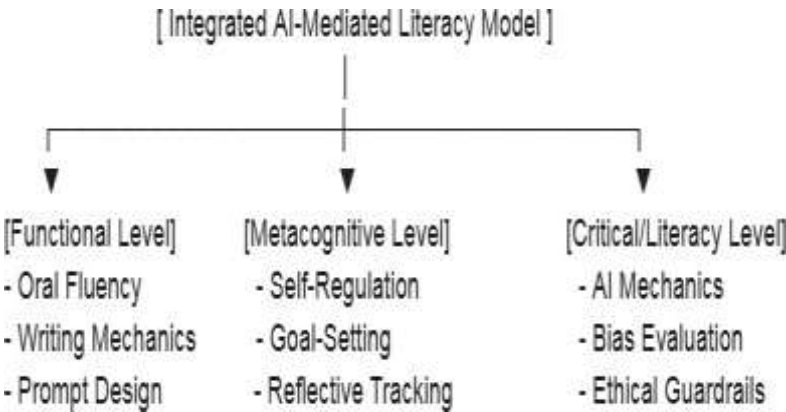
The most crucial finding from this synthesis is that functional English proficiency and AI literacy must not be taught in isolation. As LLMs and writing assistants become standard writing tools (Aini & Basthomi, 2025), a student's writing ability is increasingly determined by their ability to interact with AI. This is where the framework by Tour et al. (2025) is vital: language learners need targeted instruction to query AI effectively, identify machine-generated biases, and rewrite AI-suggested sentences to fit their authentic voices.

If students lack AI literacy, the integration of AI in writing classes can backfire, resulting in the over-reliance and plagiarism noted by Rahman (2026). However, if students are trained using the "Understand, Evaluate, and Use" paradigm (Mills et al., 2024), they learn to treat AI as a collaborative writing partner (Aini & Basthomi, 2025) rather than an automated text generator, safeguarding academic integrity while significantly elevating writing quality.

Contribution to Educational Science

This study contributes to educational science by proposing an Integrated AI-Mediated Literacy Model. This model posits that effective modern ELT is achieved when instructional technology acts on three levels simultaneously:

- 1. **The Functional Level:** Utilizing specialized AI tools (e.g., Reading Progress, writing assistants) to train reading, oral fluency, and vocabulary mechanics.
- 2. **The Metacognitive Level:** Structuring AI interactions to promote self-regulation, goal-setting, and reflective tracking.
- 3. **The Critical/Literacy Level:** Teaching the underlying principles, biases, and ethical boundaries of AI systems, ensuring students remain critical agents of their own language production.



Limitations of Current Research

While the findings are promising, several critical limitations in the existing literature must be acknowledged:

- **Sample Size Constraints:** Some empirical trials, such as Al-husban & Alabri (2025), feature small sample sizes ($N = 40$), restricting the generalizability of the quantitative findings to larger, more diverse student populations.

- **Lack of Curricular Standardization:** As synthesized by Rahman (2026), there is currently no standardized, structured curriculum for incorporating AI into writing programs, resulting in inconsistent pedagogical outcomes.
- **Ethical and Equity Barriers:** The digital divide prevents equitable access to premium AI tools (Mills et al., 2024). Moreover, inherent algorithmic biases in speech recognition (Alonzo et al., 2025) and text generation present ongoing risks for non-native English speakers.

CONCLUSIONS AND RECOMMENDATIONS

Major Summary

AI-based English learning innovations represent a powerful paradigm shift in language instruction. Empirical evidence from the synthesized studies proves that targeted AI tools dramatically improve oral reading fluency and reading comprehension, while automated writing assistants facilitate content generation and mechanical accuracy. Beyond language proficiency, these technologies successfully enhance student engagement, attentiveness, and essential self-regulated learning behaviors. However, to maximize these benefits and mitigate risks such as academic over-reliance and plagiarism, educators must combine functional language training with structured, systematic AI literacy instruction.

FURTHER STUDY

Based on the synthesis of the 2024–2026 research corpus, we present the following recommendations:

- a. **Curricular Integration:** Language departments must move away from the ad-hoc use of AI. Institutions should design structured language curricula that integrate AI literacy (Understanding, Evaluating, and Using AI) directly into reading and writing syllabi, using models like those proposed by Tour et al. (2025).
- b. **Teacher Professional Development:** Educators must be equipped with the skills to facilitate AI-based learning, balance automated feedback with human oversight, and teach students how to identify AI biases.
- c. **Focus on Self-Regulation:** Instructors should explicitly leverage AI tools to support self-regulated learning, teaching students how to utilize automated tracking features for personal goal-setting and reflection.
- d. **Future Research Directions:** Longitudinal empirical studies with larger, more diverse student samples are urgently needed to track the long-term cognitive impact of AI reliance on authentic language production and critical thinking skills.

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