The Algorithmic Scaffold: A Phenomenological Study of Artificial Intelligence's Impact on EFL Learners' Higher-Order Thinking Skills through the Lens of Motivational Self-Determination

Xuefan Feng, Fei Gao
Qingdao City University, Qingdao 266106, Shandong, China

Abstract: The rapid integration of Artificial Intelligence (AI) into higher education has precipitated a paradigm shift in English as a Foreign Language (EFL) pedagogy. While the utility of AI for basic linguistic acquisition is well-documented, its influence on Higher-Order Thinking Skills (HOTS) — specifically analyzing, evaluating, and creating — remains a subject of pedagogical debate. Drawing upon management motivation theories, specifically Self-Determination Theory (SDT), this study adopts a qualitative phenomenological research design to explore the lived experiences of first-year EFL undergraduates interacting with AI tools. Semi-structured interviews were conducted with 15 participants randomly selected from five distinct academic cohorts. The findings reveal a complex duality: while AI functions as a "competence multiplier" that scaffolds analytical thinking and reduces cognitive load, it simultaneously risks undermining learner autonomy by fostering an over-reliance that inhibits evaluative rigor. Drawing on Self-Determination Theory and management efficiency models, this study contends that the predominance of extrinsic efficiency-driven AI use — without intrinsic motivational regulation — may lead to the gradual erosion of evaluative and creative cognitive faculties, a phenomenon we term algorithmic dependency.

***Keywords*:** Artificial Intelligence (AI); Higher-Order Thinking Skills (HOTS); EFL; Self-Determination Theory; phenomenology; management in education

1. Introduction

The landscape of English as a Second Language (ESL) instruction is currently undergoing a transformation comparable to the industrial revolution' s impact on management practices. Just as automation redefined labor, Artificial Intelligence (AI) is redefining the cognitive labor of language learning. For decades, the primary objective of ESL instruction was linguistic competence—vocabulary, grammar, and syntax. However, in the modern academic context, the goal has shifted toward cultivating Higher-Order Thinking Skills (HOTS), as defined by Bloom's Revised Taxonomy: analyzing, evaluating, and creating (Anderson et al., 2001)[1].

Recent scholarship suggests that AI's role in this domain is multifaceted. As noted by Derakhshan and Taghizadeh (2025), AI acts as a "double-edged sword," offering opportunities for personalized feedback and structural guidance while simultaneously posing risks of cognitive passivity[6]. While prior research has examined AI' s cognitive impacts (Derakhshan & Taghizadeh, 2025; Liu & Wang, 2024), few studies have integrated educational motivation frameworks with management theories to explain why learners strategically—and sometimes detrimentally—adopt AI in HOTS-related tasks[2][3]. This study bridges that gap by applying Self-Determination Theory (Ryan & Deci, 2000) alongside the management-originated Efficiency Principle.Understanding why students choose to offload cognitive tasks to AI—whether driven by the management concept of "efficiency maximization" or the educational drive for "mastery"—is crucial for understanding the fate of HOTS in the digital age[4].

This study aims to bridge this gap by examining the impact of AI on HOTS from an ESL perspective, viewed through the lens of Self-Determination Theory (SDT) (Ryan & Deci, 2000)[4]. By applying a phenomenological approach to the lived experiences of first-year university students, this paper seeks to answer the following research questions:

(1) How do ESL learners perceive the role of AI in supporting or hindering their ability to analyze, evaluate, and create content in English?

(2) How do motivational factors (autonomy, competence, and relatedness) influence the extent to which learners engage in Higher-Order Thinking when assisted by AI?

2. Literature Review and Theoretical Framework

2.1 AI in the EFL Context and HOTS

The integration of AI in language learning has moved beyond simple translation tools to sophisticated Generative AI capable of complex dialogue and text production. Recent studies (e.g., Liu & Wang, 2024; Darwin et al., 2024) have assessed the influence of these tools on cognitive abilities[6][8]. Derakhshan and Taghizadeh (2025) highlight that while AI can improve problem-solving and critical thinking by acting as a "more knowledgeable other" within the Zone of Proximal Development (ZPD), over-reliance can negatively influence analytical reasoning and decision-making[2].

HOTS require learners to move beyond remembering and understanding. In an EFL context, this means not just understanding a text, but critiquing its bias (evaluating), deconstructing its argument (analyzing), and synthesizing new ideas (creating). The tension lies in whether AI serves as a scaffold that supports these difficult tasks or a crutch that bypasses them entirely.

2.2 Theoretical Framework: Integrating Management Motivation Theories

To understand the student's interaction with AI, this study integrates management motivation theories with educational psychology. Specifically, we utilize Self-Determination Theory (SDT), which posits that human motivation is driven by three innate needs:

Autonomy: The need to feel in control of one' s own behaviors and goals.

Competence: The need to gain mastery of tasks and learn different skills.

Relatedness: The need to experience a sense of belonging and attachment to other people.

From a management perspective, we also consider the Efficiency Principle (derived from Taylorism). In a high-pressure academic environment, students often manage their resources (time and cognitive effort) like efficient managers. If AI offers a path to a high-grade output with minimal cognitive expenditure, the "efficiency" motivation may override the "mastery" motivation (competence), leading to a bypass of HOTS processes. This theoretical intersection allows us to analyze not just what AI does to thinking skills, but why students allow it to happen.

2.3 Bloom's Taxonomy: A Cognitive Framework for AI-Mediated HOTS Development

Bloom's Revised Taxonomy (Anderson et al., 2001) provides a seminal framework for categorizing educational objectives along a continuum from Lower-Order Thinking Skills (LOTS) to Higher-Order Thinking Skills (HOTS)[1]. Its hierarchy—Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating—has been instrumental in designing curricula aimed at fostering deeper cognitive engagement. In the context of EFL, this taxonomy clarifies the developmental trajectory from basic linguistic knowledge (vocabulary, grammar) to sophisticated language use involving critical analysis, judgment, and original production.

The integration of AI into language learning disrupts the traditional linear progression through these cognitive stages. While AI can dramatically accelerate and support processes at the lower rungs of the taxonomy (e.g., instant translation for Remembering, paraphrasing tools for Understanding, and grammar checkers for Applying), its impact on the upper tiers—Analyzing, Evaluating, and Creating—is ambivalent and theoretically significant (Derakhshan & Taghizadeh, 2025) [6]. AI can function as a powerful cognitive scaffold within Vygotsky's Zone of Proximal Development (ZPD), enabling learners to attempt and accomplish HOTS tasks that would be beyond their unassisted linguistic capability. For instance, by offloading the cognitive burden of dense syntactic parsing, AI allows learners to focus on deconstructing argumentative logic (Analyzing).

Conversely, AI risks becoming a cognitive bypass that allows learners to circumvent the very struggles essential for HOTS development. When a learner directly accepts an AI-generated critical evaluation of a text (Evaluating) or uses a generative AI to produce the first draft of an essay (Creating), they engage in what might be termed performative HOTS—the outward appearance of high-level cognitive activity without the accompanying internal cognitive labor. This duality positions AI not merely as a tool, but as a cognitive partner that reconfigures the distribution of intellectual labor between human and machine.

This analysis directly frames the core tension explored in this study. The pedagogical challenge, therefore, shifts from merely accessing HOTS tasks to orchestrating the human-AI collaboration in a way that ensures the learner remains the primary cognitive agent, especially at the Evaluating and Creating levels. The following theoretical integration with Self-Determination Theory seeks to explain the motivational mechanisms that determine whether AI serves as a scaffold or a crutch within this Bloomian framework.

3. Methodology

3.1 Research Design

This study employs a qualitative phenomenological research design. As Creswell and Poth (2016) note, phenomenology is best suited for exploring the "essence" of participants' lived experiences regarding a specific phenomenon. Given the subjective nature of thinking processes and motivation, a qualitative approach allows for the deep inquiry necessary to understand how students internally negotiate the use of AI in relation to their cognitive development[5].

3.2 Setting and Participants

The study was conducted at a private university with a diverse undergraduate population. The participants consisted of 15 first-year EFL students. To ensure maximum variation and representativeness within the specific context of my teaching practice, a stratified random selection method was employed. Three students were randomly selected from each of five distinct EFL classes I currently instruct.

The sample is diverse regarding:

Majors: Architecture, Robotics, Software Engineering, Visual Communication and Construction Costing.

Gender: 8 female, 7 male.

Language Proficiency: A mix of elementary (A2) to intermediate (B1) levels according to the CEFR scale.

3.3 Data Collection Instruments

Data were collected through semi-structured interviews. The interview protocol was designed to probe three specific domains:

(1) Technical Interaction: How students physically use AI for assignments requiring HOTS.

(2) Cognitive Reflection: Students' self-perception of their thinking processes (metacognition) while using AI.

(3) Motivational Drivers: Questions derived from SDT and management theory regarding their reasons for AI usage (e.g., time management vs. understanding).

Example questions included: "Describe a time you used AI to critique an article. Did you feel you were doing the evaluating, or was the AI?" and "Does using AI make you feel more competent as a writer, or more dependent?"

3.4 Data Analysis

Data were transcribed and analyzed using thematic analysis. Following the six-phase paradigm (Braun & Clarke, 2006), the data underwent familiarization, coding, theme generation, and reviewing. The analysis was sensitized by the theoretical framework of SDT and HOTS[7].

4. Findings

The phenomenological analysis of the interviews revealed three major themes regarding the impact of AI on EFL learners' HOTS: (1) AI as a Competence-Enhancing Scaffold for Analysis; (2) The Autonomy Paradox in Evaluation; (3) The Efficiency-Creativity Trade-off.

4.1 Theme 1: AI as a Competence-Enhancing Scaffold for Analysis

Many participants, particularly those at the B1 and B2 proficiency levels, described AI as a vital tool for “Analyzing” (a key HOTS component). They reported that AI helped them deconstruct complex English texts that were otherwise inaccessible due to linguistic barriers.

Participant A (Construction Costing major, A2) stated:

"When I read a long case study, sometimes I get lost because of the vocabulary. I use artificial intelligence to break down the structure of the argument. This helps me see the framework of the text. Once I understand the logic, I can analyze it on my own. This makes me feel capable, as if I really have the ability to parse what the author is conveying, not just translating the words."

Here, AI supports the need for “Competence”. It removes the "lower-order" friction of vocabulary decoding, allowing the student to engage in the "higher-order" task of structural analysis. This aligns with findings from Derakhshan and Taghizadeh (2025), who noted that AI instruments can improve problem-solving abilities. In this context, AI acts as a scaffold that keeps the student in the ZPD, rather than doing the thinking for them.

4.2 Theme 2: The Autonomy Paradox in Evaluation

While analysis appeared to be supported, the skill of “Evaluating” showed a troubling trend linked to the concept of “Autonomy”. Students reported a "surrender of judgment" to the AI. When asked to evaluate the quality of a source or an

argument, students often deferred to the AI's output as an objective truth, curbing their own critical evaluation skills.

Participant B (Software Engineering major, C1) remarked:

"I was asked to evaluate the bias in an article. I asked the AI what the bias was, and it gave me three points. I just put those in my paper. I felt efficient, but... I didn't really form my own opinion. If the AI said it was biased, it was biased."

This illustrates a conflict between the management drive for efficiency and the psychological need for autonomy. The student achieved the specific outcome (completing the task) efficiently, but sacrificed intellectual autonomy. Derakhshan and Taghizadeh (2025) warn that "over-reliance on these systems can negatively influence students' cognitive capabilities, namely analytical reasoning, critical thinking, and decision-making."[8] My findings suggest this over-reliance is driven by a desire to minimize cognitive load, effectively outsourcing the "Evaluation" stage of Bloom's taxonomy.

4.3 Theme 3: The Efficiency-Creativity Trade-off

Regarding the “Creating” aspect of HOTS, participants described a homogenization of thought. While AI helped overcome "writer's block" (supporting Competence), it often standardized the creative output.

Participant C (Visual Communication major, B1) noted:

"I have great ideas in my head, but putting them into English is hard. AI helps me write them down. But sometimes, when I read the final paper, it sounds like a robot. It's perfect grammar, but the 'spark' is gone. I feel like a manager approving a report, not the writer creating it."

This participant explicitly uses management terminology ("approving a report"). The AI transforms the student from a “creator” to a “supervisor”. While "supervision" involves some evaluation, it distances the learner from the generative cognitive struggle required to develop deep creative skills.

5. Discussion

The findings of this phenomenological study suggest that the impact of AI on HOTS is mediated heavily by the learner's motivational orientation.

The Competence-HOTS Link: When students use AI to satisfy the need for “Competence” (mastery), AI tends to support “Analyzing”. By offloading lower-level processing (decoding), students free up working memory to view the "big picture." This confirms Vygotsky's view of tools as mediators of higher psychological processes (Derakhshan & Taghizadeh, 2025)[8].

The Autonomy-HOTS Disconnect: However, when the motivation is purely extrinsic (grades) or driven by management-style “Efficiency”, the skills of “Evaluating” and “Creating” suffer. The AI is no longer a scaffold; it is a replacement. This leads to what we conceptualize as hollow competence: a performative demonstration of HOTS in output, devoid of the cognitive struggle necessary for genuine skill internalization. From a management education perspective, this reflects a misalignment between short-term task efficiency and long-term cognitive development—a pedagogical challenge requiring curricular redesign. The lived experience of the student shifts from one of intellectual struggle to one of editorial management.

This mirrors the concerns raised by Zhai et al. (2024), cited in the attached article, regarding the negative effects of over-reliance. From a management theory perspective, students are behaving as "rational actors" minimizing effort for maximum gain[8]. However, in education, the "effort" (cognitive struggle) is the learning mechanism itself. By bypassing the struggle of evaluation and creation, students are effectively "managing" themselves out of an education.

6. Conclusion and Implications

This study explored the impact of AI on EFL learners' Higher-Order Thinking Skills through a phenomenological lens. We conclude that AI is neither inherently beneficial nor detrimental to HOTS; rather, its impact is determined by the motivational framework of the user.

Facilitation: AI nurtures “Analysis” when used to scaffold linguistic comprehension.

Hindrance: AI hinders “Evaluation” and “Creation” when students prioritize efficiency over cognitive autonomy.

Pedagogical Implications: As educators, specifically in ESL contexts, we must integrate "AI Motivation Training" into our curricula. We cannot simply ban or embrace the tools; we must teach students to recognize the difference between "using AI to learn" (Competence drive) and "using AI to finish" (Efficiency drive). Assignments must be redesigned to focus on the process of evaluation rather than the product. For an evaluation task, students should be required to critique the AI's output, forcing them to re-engage their critical faculties and assert their intellectual autonomy.

Limitations: This study was limited to 15 students at a single private university. Future research could expand the sample size and employ quantitative measures to correlate motivational profiles with HOTS performance in AI-integrated environments.

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