

Linguistic Forensics of AI-Generated Hallucinations in Technical Writing: Developing "Hallucination Literacy" in ESP Pedagogy

Author 1

Mr.Bharathikumar S

Assistant Professor

Department of Humanities and Social Sciences

Sri Venkateswara College of Engineering (Autonomous)

Pennalur, Sriperumbudur – 602 117

Email: bharathikumars@svce.ac.in

Author 2

Dr. Vinayagamoorthy.S

Assistant Professor

Department of English

Dhanalakshmi Srinivasan College of Engineering and Technology (Autonomous)

Mamallapuram

Chennai -600104

Email: vinayagamoorthis.english@dscet.ac.in

Abstract

The rapid adoption of Generative Artificial Intelligence (GenAI) and Large Language Models (LLMs) in technical documentation, engineering logging, and scientific writing has fundamentally altered the paradigm of professional writing instruction. While GenAI tools generate syntactically flawless and contextually fluent English, they frequently produce "hallucinations"—semantically false, fabricated, or logically distorted statements presented with high linguistic confidence. Traditional English for Specific Purposes (ESP) pedagogy emphasizes composition, rhetorical cohesion, and technical grammar. However, it fails to address the forensic, critical-editing skills required to audit AI-generated text for factual integrity. This paper introduces the concept of **Linguistic Forensics in ESP** and proposes a novel pedagogical framework termed **Hallucination Literacy**. By classifying the structural, semantic, and discourse markers unique to synthetic technical hallucinations, this paper formulates an instructional methodology designed to train engineering students and technical writers to detect, deconstruct, and remediate AI-generated inaccuracies before deployment in high-stakes industrial environments.

Keywords: Linguistic Forensics, AI Hallucinations, Technical Writing, English for Specific Purposes (ESP), Hallucination Literacy, Generative AI Pedagogy, Critical Proofreading.

Introduction

The integration of Large Language Models (LLMs) into professional engineering workflows has shifted the primary role of the technical writer from primary author to editor and auditor. In modern industrial and software environments, engineering professionals routinely leverage AI to draft technical reports, standard operating procedures (SOPs), system specifications, and code documentation.

However, LLMs operate on probabilistic next-token prediction rather than deterministic truth verification. Consequently, AI models frequently output "hallucinations"—plausible-sounding yet entirely incorrect technical claims, non-existent standard compliance codes, spurious citations, or physically impossible system tolerances. Because LLMs maintain sophisticated register control, precise terminology, and immaculate syntax, these hallucinations bypass standard human proofreading mechanisms, which historically relied on grammatical markers or awkward phrasing to spot textual errors.

This phenomenon presents an urgent challenge for English Language Teaching (ELT) and English for Specific Purposes (ESP). Traditional technical writing courses assume that grammatical fluency correlates with truth value. In synthetic text, however, syntactic perfection often masks severe semantic fabrication. To address this risk, ESP pedagogy must incorporate **Linguistic Forensics**—the systematic application of linguistic analysis to investigate, verify, and audit textual integrity—establishing **Hallucination Literacy** as an essential 21st-century technical communication skill.

Problem Statement

Current technical communication and ESP curricula suffer from a structural misalignment with modern workplace writing practices:

- 1. The Syntactic Trap:** Students and technical professionals are conditioned to evaluate English proficiency based on surface-level correctness (grammar, vocabulary choice, transitions). Because AI-generated hallucinations are syntactically pristine, users suffer from automation bias, accepting false data at face value.
- 2. Absence of Forensic Editing Models:** Existing editing rubrics focus on clarity, brevity, and tone. They do not provide systematic methodologies for detecting "semantic drift," phantom citations, or fabricated domain-specific jargon generated by AI interfaces.
- 3. High Operational Risk:** In high-risk technical domains (such as civil infrastructure, biomedical engineering, and aerospace), deploying unvetted AI hallucinations in safety manuals or design documentation leads to catastrophic physical, financial, and legal consequences.

Analysis: Taxonomy of Synthetic Hallucinations in Technical Discourse

Linguistic forensics isolates the structural and semantic mechanics of AI hallucinations in technical documentation. Unlike human error, which typically stems from miscommunication or lack of domain knowledge, synthetic hallucinations follow specific algorithmic patterns.

Forensic Taxonomy of AI Hallucinations in Technical Writing

- **Fabricated Nomenclature (Phantom Jargon):** The LLM constructs linguistically plausible terms by combining real technical affixes and roots (e.g., specifying a "non-linear piezoresistive dampening coefficient" that does not exist in material science).
- **Pseudo-Citation & Reference Spoofing:** The model generates perfectly formatted APA/IEEE references, complete with plausible author names, journal titles, and fake DOIs, to justify unverified technical parameters.
- **Semantic Drift in Operational Constraints:** The text maintains logical cohesion but quietly alters critical numerical thresholds or relational logic (e.g., swapping "must not exceed 50°C" to "must maintain 50°C"), fundamentally altering safety parameters.
- **Over-Generalization of Edge Cases:** The AI projects general engineering rules onto highly specific, exception-heavy operating environments without signaling uncertainty or conditional boundaries.
- **Spurious Causal Assertions:** The LLM uses high-certainty discourse markers (such as *consequently*, *hence*, *it is empirically established that*) to connect two unrelated engineering variables, creating an illusion of logical necessity.

The "Hallucination Literacy" Pedagogical Framework

To operationalize linguistic forensics in the ESP classroom, this paper proposes a sequential four-stage instructional model aimed at developing **Hallucination Literacy**:

• Stage 1: Forensic Deconstruction

Learners begin by isolating high-risk linguistic zones within AI-generated drafts. This involves flagging modal verbs, numerical values, technical standards, proper nouns, and assertive discourse markers that require empirical validation.

• Stage 2: Cross-Verification & Fact-Auditing

In the second phase, students systematically benchmark synthetic claims against ground-truth technical data, peer-reviewed literature, official codebooks (e.g., ISO, IEEE), and primary engineering databases to establish factual validity.

- **Stage 3: Certainty & Epistemic Calibration**

Learners evaluate the epistemic modality of the text, removing overly assertive or ungrounded claims (e.g., changing *"The system guarantees zero failure"* to appropriately bounded statements such as *"Under tested operating conditions A and B, failure rates remained within specified parameters"*).

- **Stage 4: Prompt Remediating & Re-Steering**

In the final phase, students diagnose the initial prompt failures that permitted the hallucination, rewriting system prompts with strict negative constraints, explicit context boundaries, and ground-truth references to prevent recurring synthetic errors.

Research Gap

A review of current literature in Applied Linguistics, ESP, and Digital Humanities reveals critical unaddressed dimensions:

- **Lack of Empirical Rubrics:** There are currently no validated empirical rubrics in ELT to measure a learner's accuracy in detecting semantic hallucinations in AI-generated technical English.
- **Over-Reliance on Detection Software:** Most educational research focuses on AI-detection tools (which attempt to identify if text was written by AI) rather than pedagogical frameworks that train human learners to critically evaluate the *truth value* of synthetic text.
- **Cognitive Fatigue in AI Auditing:** Limited research explores the cognitive load and proofreading fatigue experienced by technical writers when auditing long-form synthetic documentation compared to human-authored drafts.

Scope of the Study

The operational scope for implementing Hallucination Literacy within technical communication includes:

1. **Target Learners:** Undergraduate engineering students, technical communicators, software documentation writers, and corporate technical trainees.

2. **Curricular Domain:** Technical writing modules, English for Science and Technology (EST), professional communication, and digital rhetoric courses in higher education.

3. **Interdisciplinary Boundaries:** Merging Applied Linguistics, Forensic Linguistics, Technical Communication, and Information Verification methodologies.

4. **Exclusions:** This framework does not cover creative writing, literary translation, or general conversational English, where "hallucinations" or imaginative text generation do not carry physical safety or compliance risks.

Conclusion

As Generative AI tools become ubiquitous in technical industries, the primary objective of English for Specific Purposes must evolve. Teaching students how to generate well-formed English sentences is no longer sufficient when AI can produce fluent prose in seconds. The new frontier of ESP pedagogy lies in **Linguistic Forensics and Hallucination Literacy**—equipping technical professionals with the critical, forensic skills required to detect synthetic falsehoods, audit machine-generated claims, and maintain strict semantic integrity in professional documentation. Integrating these competencies into technical curricula ensures that human oversight remains the ultimate guarantee of truth and safety in Industry 5.0.

References

1. Ji, Z., Lee, N., Frieske, R., Yu, T., Su, D., Yan, X., ... & Fung, P. (2023). Survey of hallucination in natural language generation. *ACM Computing Surveys*, 55(12), 1-38.
2. Swales, J. M. (1990). *Genre analysis: English in academic and research settings*. Cambridge University Press.
3. Hyland, K. (2005). *Stance and engagement: A model of interaction in academic discourse*. *Discourse Studies*, 7(2), 173-192.
4. Coulthard, M., Johnson, A., & Wright, D. (2016). *An introduction to forensic linguistics: Language in evidence*. Routledge.
5. Selfe, C. L. (1999). *Technology and literacy in the twenty-first century: The importance of paying attention*. *Computers and Composition*, 16(3), 341-368.
6. White, J., Fu, Q., Mushkoor, S., Moreno-Velo, F., & Schmidt, D. C. (2023). A prompt pattern catalog to enhance prompt engineering with ChatGPT. *arXiv preprint arXiv:2302.11382*.
7. Biber, D., & Conrad, S. (2019). *Register, genre, and style*. Cambridge University Press.

Copyright & License:

© Authors retain the copyright of this article. This work is published under the Creative Commons Attribution 4.0 International License (CC BY 4.0), permitting unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.