Epistemic Writing in Engineering: Genre-Based Pedagogy, Disciplinary Feedback, and Generative AI from a Latin American WAC/WID Perspective

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Abstract

This document presents a work in progress situated in Writing Across the Curriculum (WAC), Writing in the Disciplines (WID), and genre-based writing research, examining epistemic writing in engineering education from a Latin American perspective. In many Spanish-speaking engineering programs, key disciplinary genres—particularly technical reports and final project reports—function as central evaluative and epistemic tools, yet writing instruction and feedback remain largely normative, fragmented, and focused on surface-level correctness. Drawing on genre-based pedagogy, corpus linguistics, and academic literacies research developed in Latin America, this study conceptualizes writing as a situated epistemic practice through which students construct disciplinary knowledge and negotiate entry into professional communities. Building on previous empirical research, the document introduces the project to the development of PEUMO_IAG, an extension of a corpus-informed writing support platform that integrates disciplinary epistemic feedback with generative artificial intelligence (GenAI). The project aims *to evaluate the impact of feedback using generative artificial intelligence in the PEUMO computational tool on the quality of writing of the technical report genre in engineering*. The research process includes to design and validate a disciplinary epistemic feedback taxonomy, to compare human and GenAI-generated feedback, to examine writing processes through learning analytics and to validate the results using the Argument-based validation framework (Kane, 2013).

1. Introduction

Within Writing Across the Curriculum and Writing in the Disciplines traditions, writing is understood as a central epistemic practice through which disciplinary knowledge is constructed, evaluated, and communicated. In engineering education, however, writing often occupies a marginal position, framed primarily as a vehicle for reporting results rather than as a means of reasoning, problem framing, and knowledge building. This tension is particularly visible in Spanish-speaking and Latin American contexts, where

the expansion of higher education has brought increasingly heterogeneous student populations into programs that rely heavily on complex evaluative genres.

Research in Latin America has shown that students are expected to produce genres such as technical reports and final project reports without sustained disciplinary guidance on their rhetorical, epistemic, and genre-specific demands. In response, genre-based and corpus-informed approaches have sought to make disciplinary writing expectations visible and teachable, positioning writing as a socially situated practice rather than a set of transferable skills. The present study builds on this tradition and frames writing support as an issue of epistemic access and educational equity (Venegas, Lillo-Fuentes & Sologuren, 2022).

META – Orientation for Workshop Dialogue

This document is presented as work in progress. Feedback from workshop participants is particularly welcome on: (a) how finely epistemic work in engineering writing can and should be modeled through disciplinary feedback categories; (b) how genre-based rhetorical expectations intersect with cognitive and epistemic operations in students' writing processes (more specifically self-regulation and monitoring processes); (c) how human and GenAI feedback can be compared without reducing writing to surface-level textual features, and (d) how to ensure the stability of LLM model considering the fast evolution of this tools and the replicability of results.

2. The Project

This project examines epistemic writing in engineering through the design, implementation, and validation of a digitally mediated feedback model integrated into PEUMO (www.peumo.org) - (Plataforma de Escritura Universitaria con Mediación Online) - a GenAI-enhanced version of an existing genre-based writing support platform for Spanish-speaking engineering students (www.redilegra.com/peumo). The study addresses not only whether GenAI–mediated feedback improves textual quality, but how different forms of feedback shape students' epistemic engagement with disciplinary genres during the writing process.

The overarching objective is *to evaluate the impact of feedback using generative artificial intelligence in the PEUMO computational tool on the quality of writing of the technical report genre in engineering.*

More specifically, the project seeks: a) To determine an effective feedback model for learning epistemic writing in digital contexts, b) to compare the application of the feedback model in digital contexts between a group of human evaluators and a language model, and c) to evaluate the impact of integrating a generative AI model into a platform that supports epistemic writing of the technical report genre.

Methodologically, the study adopts a mixed-methods design with a comparative and relational scope. It combines a qualitative, non-experimental component focused on the construction and validation of the epistemic feedback taxonomy with a quasi-experimental factorial design (2 × 2) involving both intra- and inter-subject comparisons. This design reflects a conception of writing as both process and product, and of feedback as a mediational practice embedded in disciplinary activity.

The research is conducted in undergraduate engineering programs at two Chilean universities. Participants are engineering students enrolled in courses that require the production of technical reports, as well as faculty members who contribute to interviews, focus groups, and expert validation procedures. The empirical corpus consists of student-produced technical reports belonging to the evaluative macrogenre of engineering reporting, including key sections such as introductions, methods, and results. A methodological decision still under consideration concerns which macromoves or sections best represent epistemic work in engineering reports, an issue previously addressed through a focus on Introductions and Results.

All procedures involving human participants comply with institutional ethical guidelines; participation is voluntary, informed consent is obtained, data are anonymized, and the use of AI-mediated feedback does not replace human evaluation nor affect students' academic assessment.

A central component of the project is the development of a disciplinary epistemic feedback taxonomy. This taxonomy is constructed through a targeted review of recent empirical literature, qualitative data from interviews and focus groups, and expert judgment procedures. Feedback categories are defined according to their epistemic orientation, discursive focus, and pedagogical function, and their reliability is established through inter-rater agreement analyses.

To examine AI-mediated feedback, the project compares several large language models (LLM) with demonstrated performance in Spanish, including ChatGPT-4o, Claude 3 Haiku, Grok3, and Qwen 2.5 (META: I'm not sure to use all of them or others). A modular computational evaluation framework implemented in the tool as "promptingLAb" is already developed. Model performance will be assessed using precision, recall, and F1-score metrics, complemented by qualitative analyses of feedback relevance and disciplinary alignment.

The pedagogical intervention follows a quasi-experimental pretest–posttest design with control and experimental groups. Writing quality is assessed using analytically designed rubrics aligned with the macrogenre of the technical report, while learning analytics derived from platform interaction logs are used to examine revision behaviors, feedback uptake, and patterns of interaction with GenAI-mediated feedback.

The Kane's Argument-based validation framework will be used to validate the results obtained.

3. Institutional Context

The research is situated in the School of Computer Engineering at the Pontificia Universidad Católica de Valparaíso (Chile), a private institution with public orientation service. Engineering programs within this context rely heavily on technical reports and final project reports as capstone evaluative genres that mediate students' transition from academic training to professional practice (Sologuren, 2022). Although writing competence is explicitly included in graduate profiles, instructional support has traditionally emphasized formal correctness over epistemic reasoning and genre awareness. To increase institutional comparability, the study also considers the inclusion of a second regional university with similar curricular conditions.

PEUMO emerged as a response to this institutional and curricular context. Developed through sustained collaboration between linguists and engineering students, the platform integrates genre models of reports, corpus evidence, and automated analysis to support disciplinary writing in Spanish. The present project extends this work by critically exploring the pedagogical integration of GenAI within a genre-based and epistemically oriented framework of feedback.

4. Key Theorists and Theoretical Frames

This project is guided by a small set of complementary theoretical traditions that frame writing as a socially situated, epistemic, and disciplinary practice. These perspectives inform both the research design and the pedagogical integration of generative AI–mediated feedback (Graham, 2018).

Writing as an Epistemic and Disciplinary Practice. Drawing on research in epistemic writing and disciplinary discourse, writing is conceptualized as a central means through which knowledge is constructed, transformed, and evaluated within specific communities (Parodi, 2004; Castelló & Mateos, 2015; Graham,2018). From this perspective, writing in engineering is not merely a vehicle for reporting results but a site of reasoning, decision-making, and disciplinary positioning, foregrounding metacognition, self-regulation, and authorial agency.

Genre-Based Pedagogy and Academic Literacies. The study aligns with genre-based pedagogy (Bawarshi & Reiff, 2010; Navarro, 2019) and academic literacies traditions that conceptualize genres as socially organized responses to recurrent communicative situations rather than as neutral text types. Latin American research has emphasized grounding writing instruction in empirical analyses of local disciplinary corpora,

highlighting variation across languages, institutions, and disciplines (Venegas, Lillo-Fuentes & Sologuren, 2022).

Feedback, Self-Regulation, and Feedback Literacy. Feedback is understood as a dialogic process that supports learners' capacity to monitor, evaluate, and regulate their writing (Hattie & Timperley, 2007; Nicol, 2010). The notion of disciplinary feedback literacy (Carless & Winstone, 2020) emphasizes feedback that supports epistemic decision-making rather than surface correction.

Argument-Based Validation. The project adopts Kane's (2013) argument-based validation framework, treating validity as an evidentiary argument linking feedback processes, writing performances, and claims about epistemic development.

GenAI as Pedagogical Mediation. GenAI is approached as a rapidly evolving set of systems whose effectiveness and pedagogical implications change over time (Kasneci et al., 2023; Kosmyna et al., 2025). Rather than seeking a stable or optimal model, the project treats LLM's selection as a matter of pedagogical and rhetorical judgment, prioritizing alignment with genre-specific purposes, support for epistemic engagement, transparency of outputs, and institutional and ethical safeguards for student agency.

5. Theoretical Positioning

Situated at the intersection of WAC/WID research, genre studies, and academic literacies, this study conceptualizes writing as a socially embedded epistemic activity. In engineering, the technical report is understood as an evaluative macrogenre whose rhetorical organization reflects disciplinary values and epistemic priorities. Feedback, therefore, functions as a key mediational resource for supporting epistemic reasoning and disciplinary enculturation.

6. Expected Contributions and Open Questions

The project seeks to contribute to WID by providing empirically grounded evidence on epistemic writing in engineering, extending genre-based pedagogical approaches to GenAI-mediated feedback, and foregrounding Latin American perspectives often underrepresented in international discussions. At the same time, it raises open questions about how epistemic development can be operationalized beyond textual quality and how GenAI-mediated feedback can be integrated without undermining authorial agency. Another open issue concerns the role of human evaluators. Engineering instructors typically evaluate reports without an explicit feedback framework; in this project, an epistemic feedback model is operationalized in the LLM and used as a reference point for comparison with feedback produced by linguists and

engineering faculty (probably we will need to offer a training to the faculty members, but only after the research?).

META: PEUMO (version1) is working and was validated with introductions in engineering. The upgrade PEUMO (version2) is online now, but we still need to evaluate the performance of the prompts and LLM's. It's necessary to compare with the previous version? (probably yes if we change the macromove and moves).

7.- Glossary

Epistemic writing: Writing conceived as a cognitive and discursive practice through which disciplinary knowledge is constructed and evaluated.

Macrogenre: A higher-order genre category grouping genres with shared evaluative and communicative purposes.

Epistemic feedback: Feedback oriented toward reasoning, decision-making, and meaning-making rather than surface-level correction.

Generative Artificial Intelligence (GAI): Large language models capable of generating text and feedback based on probabilistic patterns.

PEUMO / PEUMO_IAG: A digital platform for disciplinary writing support; PEUMO_IAG denotes its generative AI–enhanced version.

8.- References

Carless, D., & Winstone, N. (2020). Teacher feedback literacy and its interplay with student feedback literacy. *Teaching in Higher Education*, 25(8), 980–997.

Castelló, M., & Mateos, M. (2015). Faculty and student representations of academic writing at Spanish universities. *Cultura y Educación*, 27(3), 477–503.

Graham, S. (2018). A revised Writer(s)-Within-Community model of writing. Educational Psychologist, 53:4, 258-279.

Hattie, J., & Timperley, H. (2007). The power of feedback. *Review of Educational Research*, 77(1), 81–112.

Kane, M. T. (2013). Validating the interpretations and uses of test scores. *Journal of Educational Measurement*, 50(1), 1–73.

Kasneci, E., et al. (2023). ChatGPT for good? On opportunities and challenges of large language models for education. *Learning and Individual Differences*, 103, 102274.

Kosmyna, N., et al. (2025). Your brain on ChatGPT: Accumulation of cognitive debt when using an AI assistant for essay writing tasks. https://arxiv.org/pdf/2506.08872

Navarro, F. (2019). Aportes para una didáctica de la escritura académica basada en géneros discursivos. *DELTA: Documentação de Estudos em Lingüística Teórica e Aplicada*, 35.

Nicol, D. (2010). From monologue to dialogue: Improving written feedback processes in mass higher education. *Assessment & Evaluation in Higher Education*, 35(5), 501–517.

Parodi, G. (2004). Texts of specialization and technical–professional discourse communities: A corpus-based approach. *Estudios Filológicos*, (39), 7–36.

Venegas, R., Lillo-Fuentes, F. & Sologuren, E. (2022). Patrones retóricos y enseñanza de la escritura disciplinar en español basada en corpus. In Giovanni Parodi, Manuel Cantos & Chad Howe (eds.). *The Routledge Handbook of Spanish Corpus Linguistics* (págs. 325 – 341). New York: Routledge.