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Toward an Ethical and Pedagogical Framework for Generative AI in Foreign Language Education: Implications for Engineering and Technology Programs in Higher Education

Dionelio Jesús Moreno Villalobos ¹

Universidad EAN, Bogotá, Colombia

Corresponding author: dioneliomoreno81@gmail.com

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Article info	Abstract
Keywords: Generative artificial intelligence; Foreign language education; Engineering and technology programs in higher education; Pedagogical mediation; Learner autonomy; AI literacy.	Background: Generative artificial intelligence (GenAI) is changing higher education by expanding access to feedback, simulated interaction, and personalized support. In foreign language education, however, its pedagogical value remains contested because the same tools that may scaffold oral and written production can also encourage dependence, superficial correctness, authorship ambiguity, and uncritical automation. Objective: This conceptual article proposes an ethical and pedagogical framework for integrating GenAI into foreign language education, with specific implications for engineering and technology programs in higher education. Methods: The study develops an integrative conceptual synthesis based on transparent literature mapping conducted with Elicit and cross-checked through scholarly and institutional sources published mainly between 2022 and 2026, alongside foundational works on communicative competence, autonomy, mediation, and assessment. Results: The analysis yields the MAICA Framework, a Mediated AI Communicative Agency model organized around five interdependent dimensions: pedagogical mediation, communicative production, disciplinary transfer, learner agency, and ethical and critical AI literacy. The article also formulates a six-stage AI mediated communicative task cycle that guides learners from task orientation, guided prompting, and drafting or rehearsal to critical revision, transparent submission or performance, and reflective transfer. Conclusions: GenAI should not be treated as a shortcut for language performance or a replacement for teacher expertise. Its educational contribution depends on thoughtful task design, transparent assessment, teacher mediation, and students' capacity to question, adapt, verify, and ethically declare AI assistance. The framework offers a practical conceptual contribution for language educators working with students who need communicative competence and responsible technological agency.

1. Introduction

Generative artificial intelligence has moved from being a peripheral technological novelty to becoming an everyday instrument for writing, translation, explanation, feedback, simulation, and academic communication in higher education. Large language models are increasingly used by students to clarify concepts, draft texts, prepare presentations, rehearse dialogues, generate examples, improve grammar, and receive immediate feedback. This expansion has produced legitimate enthusiasm because GenAI can make instructional support more accessible, flexible, and personalized. It has also produced concern because its use can blur the boundaries between support and substitution, learning and performance, authorship and automation, and assistance and dependence (Kasneci et al., 2023; Miao & Holmes, 2023; Yan et al., 2023).

Recent international surveys indicate that this shift has moved beyond experimentation. The Digital Education Council's Global AI Student Survey, based on 3,839 responses across 16 countries, reported that 86% of students already incorporate AI into their studies and 54% use it weekly (Digital Education Council, 2024). In the United Kingdom, the HEPI/Kortext Student Generative AI Survey 2025 found that 92% of undergraduates use AI in some form and 88% have used GenAI for assessments (Freeman, 2025). In Latin American higher education, a 2026 survey involving more than 30,000 responses from 29 institutions reported active AI engagement among 92% of students and 79% of faculty (Digital Education Council, 2026). These figures suggest that GenAI is no longer an optional or

marginal resource; it is becoming an embedded condition of academic work, which makes the pedagogical regulation of its use especially urgent.

Foreign language education is particularly sensitive to these tensions. Language learning is not limited to producing formally correct sentences; it involves communicative intention, pragmatic adequacy, intercultural awareness, interactional competence, learner identity, and the gradual development of autonomy. A student may obtain a grammatically polished text from a chatbot without being able to explain, adapt, pronounce, defend, or transfer that text to a real communicative situation. Similarly, a learner may use AI to rehearse an oral presentation and still remain dependent on scripted responses that do not reflect spontaneous interaction. These tensions are pedagogically significant because the quality of foreign language learning cannot be measured only by the fluency of the final product. It must also be interpreted through the processes of planning, negotiating meaning, revising, reflecting, and taking responsibility for language choices (Canale & Swain, 1980; Council of Europe, 2020; Hymes, 1972).

The issue becomes even more relevant in engineering and technology programs in higher education. Engineering students and students in technology programs increasingly require foreign language competence for technical documentation, international collaboration, academic mobility, conference participation, project reporting, innovation ecosystems, and professional communication. For these learners, language is not an isolated academic subject; it is a medium for explaining processes, justifying decisions, presenting prototypes, negotiating constraints, and communicating specialized knowledge. GenAI can support this process by generating examples of technical genres, modeling explanations, suggesting vocabulary, and simulating professional scenarios. Nevertheless, if it is integrated without pedagogical criteria, it may also weaken technical authorship, reduce rhetorical ownership, and normalize unverified content in contexts where precision, accountability, and ethical responsibility are essential (Adauto-Medina et al., 2026; Rosandić, 2026; Sinkus & Ozola, 2024).

This article responds to a conceptual gap in literature. Much of the current debate has focused either on the opportunities of GenAI in education or on its risks for academic integrity. Less attention has been paid to how language educators can theoretically organize GenAI use around communicative agency, disciplinary transfer, and ethical mediation, especially in engineering and technology contexts. The central argument developed here is that GenAI can become a productive pedagogical scaffold only when it is placed inside a human centered didactic architecture. This means that teachers must define the purpose of AI use, students must learn to evaluate and transform AI output, and assessment must prioritize process, transparency, and communicative ownership rather than only the polished final text.

The objective of this conceptual article is to propose an ethical and pedagogical framework for the integration of GenAI in foreign language education, with implications for engineering and technology programs in higher education. The article develops the MAICA Framework, which stands for Mediated AI Communicative Agency. The framework integrates five dimensions: pedagogical mediation, communicative production, disciplinary transfer, learner agency, and ethical and critical AI literacy. These dimensions are not presented as isolated categories, but as a system for designing tasks, guiding feedback, reducing dependence, and strengthening responsible language production.

2. Review Literature

2.1 Generative AI in higher education: from automation to mediation

GenAI in higher education is commonly associated with acceleration, personalization, and automated assistance. Students can receive instant explanations, summaries, examples, and feedback, while teachers can generate teaching materials, adapt texts, design rubrics, and create differentiated practices. This functional view is useful but incomplete. If GenAI is interpreted only as an efficiency tool, its role becomes narrowly instrumental: it produces faster texts, faster feedback, and faster answers. A more pedagogical interpretation is needed. UNESCO's guidance on GenAI in education and research argues for a human centered approach in which regulation, capacity building, and human agency remain central to educational adoption (Miao & Holmes, 2023). Similarly, the European Commission (2022) emphasizes the need for educators to engage with AI critically and ethically, not only operationally.

Recent literature increasingly conceptualizes AI as a mediational tool rather than a neutral machine. From a sociocultural perspective, learning occurs through mediated activity, interaction, tools, signs, and social participation. Vygotsky's notion of the zone of proximal development remains relevant because GenAI can provide forms of adaptive scaffolding, but it cannot replace the cultural intentionality, ethical judgement, and contextual sensitivity of human mediation (Vygotsky, 1978; Wood et al., 1976). Hönigsberg et al. (2025) show that GenAI can mediate literacy development in higher education when students engage with it through guided tasks that promote both subject knowledge and GenAI literacy. Naik (2026) similarly reinterprets AI assisted

learning through sociocultural theory, highlighting the need to combine algorithmic support with learner agency and teacher guidance.

This mediational interpretation has two consequences for educational design. First, the value of GenAI depends less on the tool itself and more on the quality of the pedagogical relation in which it is embedded. Second, the presence of AI requires educators to redesign assessment and learning tasks so that students cannot simply outsource cognition. Instead, they must explain prompts, justify revisions, compare alternatives, identify hallucinations, and reflect on the limits of machine generated language. In this sense, GenAI should be integrated through moderated use, guided interaction, and explicit literacy development rather than unrestricted automation (Celik, 2022; Ding & Magerko, 2026; Tan et al., 2025).

2.2 GenAI, foreign language learning, and communicative competence

Foreign language education has a long tradition of connecting language production with social use, communicative purpose, and interaction. Communicative competence involves grammatical, sociolinguistic, discourse, and strategic dimensions (Canale & Swain, 1980). Hymes (1972) emphasized that knowing a language involves knowing not only what is formally possible, but also what is appropriate in specific social contexts. The CEFR Companion Volume extends this communicative orientation by emphasizing mediation, interaction, online communication, plurilingual resources, and the active role of learners as social agents (Council of Europe, 2020). These perspectives are crucial for GenAI integration because AI generated output can be linguistically correct but pragmatically limited, culturally generic, or disconnected from the learner's actual communicative repertoire.

Research on ChatGPT and language learning identifies several affordances. Chatbots can support vocabulary development, grammar explanation, writing improvement, translation awareness, conversational simulation, and learner motivation (Baskara & Mukarto, 2023; Kohnke et al., 2023; Law, 2024). Kohnke et al. (2023) argue that language teachers and learners need digital competencies to use ChatGPT ethically and effectively. Law's scoping review shows that GenAI applications in language education are expanding, but the evidence base remains uneven across skills, contexts, and methodological designs. Lee et al. (2025), in a systematic review of GenAI in language classrooms, also report that recent empirical research has grown quickly but continues to concentrate heavily on text based skills. This creates a conceptual risk: GenAI may be reduced to writing assistance while its impact on oral interaction, pragmatic competence, intercultural mediation, and spontaneous communicative performance remains insufficiently theorized.

Oral production requires special attention. Oral language involves timing, intonation, pronunciation, turn management, hesitation management, repair strategies, audience awareness, and embodied confidence. A chatbot may generate prompts or scripts for speaking practice, but it cannot fully reproduce the social density of human interaction. For this reason, AI supported speaking tasks should be designed as rehearsal spaces rather than replacements for authentic communication. Learners can use AI to prepare ideas, model expressions, receive pronunciation suggestions, or simulate professional scenarios, but they should later perform, adapt, negotiate, and reflect in human interaction. The educational challenge is to transform AI supported preparation into communicative growth rather than script dependence (Fang & Han, 2025; Lantolf, 2000).

2.3 Learner autonomy, self-regulation, and agency in AI mediated environments

Learner autonomy has traditionally referred to the capacity to take charge of one's own learning (Little, 1991). In language education, autonomy includes goal setting, strategy selection, self-monitoring, resource management, and reflective evaluation (Benson, 2011). GenAI complicates this concept because it can both support and weaken autonomy. It may help learners clarify doubts, compare examples, receive immediate feedback, and practice beyond the classroom. At the same time, it may reduce effort, encourage passive acceptance of machine output, and create the illusion of competence when students submit refined language they cannot reproduce independently.

This tension requires a distinction between operational autonomy, strategic autonomy, and critical autonomy. Operational autonomy refers to the ability to use tools effectively. Strategic autonomy refers to the ability to choose when, why, and how to use a tool in relation to a learning goal. Critical autonomy refers to the ability to evaluate the epistemic, ethical, linguistic, and communicative consequences of tool use. GenAI integration should move students from operational use toward strategic and critical use, as represented in Figure 1. Otherwise, AI literacy remains superficial and becomes limited to prompt writing or tool familiarity (Archambault et al., 2025; Mammadova, 2026; Ng & Lai, 2025).

Self-regulated learning theory also offers a useful lens. Zimmerman (2002) describes self-regulation as a cyclical process involving forethought, performance, and reflection. In AI mediated language learning, this cycle can be enriched if learners use GenAI to plan, rehearse, revise, monitor gaps, and reflect on improvement. However, self-regulation is weakened if the tool performs the central cognitive work without requiring the learner

to make decisions. The pedagogical objective is therefore not to ban AI or celebrate it uncritically, but to structure its use so that students remain responsible for intention, evaluation, revision, and transfer (Flower & Hayes, 1981; Hönigsberg et al., 2025).

Three tiers of learner autonomy in AI-mediated environments

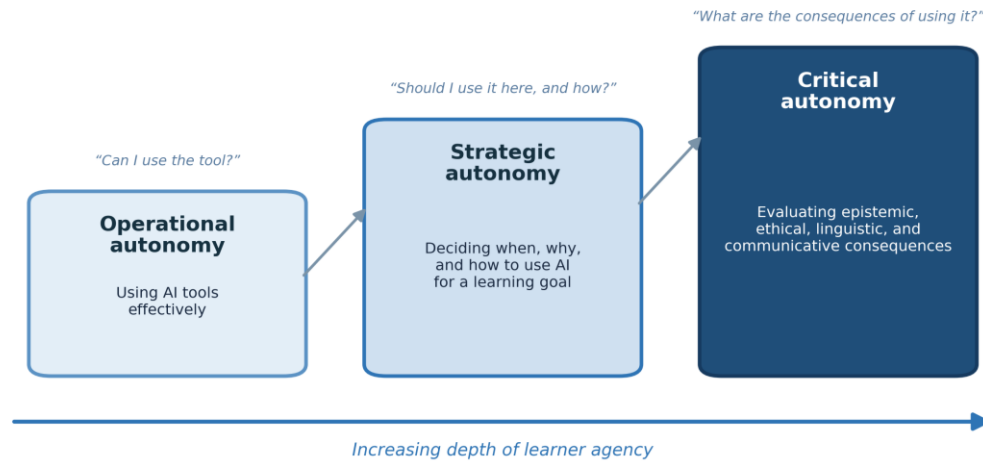


Figure 1: Three tiers of learner autonomy in AI mediated environments- elaboration based on Benson (2011), Little (1991), and Zimmerman (2002).

2.4 Engineering and technology programs in higher education and academic communication

Engineering and technology programs in higher education provide a fertile context for integrating GenAI into foreign language education because professional communication in engineering requires precision, clarity, problem solving, collaboration, and accountability. Engineering students often need to write technical reports, explain procedures, describe data, present prototypes, defend design choices, and collaborate in multilingual environments. In these genres, language learning is not merely grammatical; it is rhetorical, disciplinary, and ethical. Students must learn to communicate specialized content without losing accuracy or responsibility.

Recent studies identified through the literature mapping suggest that engineering students already use AI tools for vocabulary, writing, comprehension, technical terminology, and academic communication. Sinkus and Ozola (2024) report that engineering students in ESP contexts value AI support but also recognize risks related to plagiarism, overreliance, and loss of communication skills. Adaauto-Medina et al. (2026) connect GenAI use with technical report writing and writing self-efficacy among engineering students. Rosandić (2026) shows that combining AI and corpus tools can support technical communication in language for specific purposes, particularly when students work with specialized collocations and terminology. These contributions suggest that engineering and technology language education needs frameworks that connect linguistic development, AI literacy, and disciplinary communication.

The concept of disciplinary transfer is therefore central. A foreign language task for engineering students should not only ask them to produce generic texts or dialogues. It should ask them to explain a process, compare alternatives, justify a design, report a problem, summarize technical information, or present a solution to a specific audience. GenAI can assist in modeling these genres, but students must learn to adapt, verify, and personalize output. The central question is not whether GenAI can write technical language, but whether students can use AI mediated support to become more capable communicators in their future academic and professional communities.

2.5 Ethical and institutional conditions for responsible GenAI use

Ethical integration is not an accessory component of GenAI use; it is a structural condition for educational legitimacy. Concerns include hallucinated information, fabricated references, data privacy, bias, plagiarism, authorship ambiguity, inequitable access, and excessive dependence on AI generated language (Bozkurt, 2024; European Commission, 2022; Yan et al., 2023). In academic writing, these risks are particularly visible because students may submit language that is formally accurate but epistemically weak or insufficiently owned. In speaking, risks can appear as memorized AI scripts, reduced improvisation, or a mismatch between the student's actual proficiency and the submitted or performed product.

UNESCO's AI Competency Framework for Teachers organizes teacher development around a human centered mindset, ethics of AI, AI foundations and applications, AI pedagogy, and AI for professional learning

(UNESCO, 2024). This is highly relevant for language education because teachers are not only evaluators of finished texts; they are designers of communicative conditions. They must help students understand when AI assistance is legitimate, how to declare it, how to verify output, how to protect data, and how to avoid replacing their own learning process. Responsible integration also requires assessment policies that differentiate acceptable support from inappropriate outsourcing (Mikroyannidis et al., 2025; Wang et al., 2023).

A detection focused approach is insufficient. AI detection tools are imperfect and can generate false accusations or superficial compliance. A more educationally coherent approach is process focused: students should document prompts, compare drafts, explain revisions, identify AI limitations, and reflect on how the tool supported or distorted their learning. This shifts the conversation from punishment to accountability. It also aligns with the idea that academic integrity is not only a matter of policing misconduct, but a pedagogical ecosystem that cultivates responsible authorship and transparent learning practices (Bozkurt, 2024; Maleki, 2026).

3. Methodology

This article follows a conceptual design. It does not report experimental data, survey findings, interviews, or classroom intervention results. Instead, it develops an integrative synthesis of recent literature and policy frameworks to formulate a pedagogical model for responsible GenAI integration in foreign language education. The manuscript is therefore positioned as an original conceptual article rather than as a systematic review or empirical study.

The literature mapping was conducted between March and June 2026 through iterative searches in Elicit and complementary verification in Google Scholar, publisher pages, institutional repositories, and DOI records when available. Searches combined Boolean logic and semantic variations around the following strings: “generative AI” AND “higher education”; “ChatGPT” OR “large language models” AND “language learning”; “generative AI” AND “foreign language education”; “AI literacy” AND “higher education”; “responsible AI” AND “education”; “AI pedagogy” AND “teacher mediation”; “engineering students” AND “ESP” AND “AI”; “technical communication” AND “generative AI”; and “academic integrity” AND “AI assessment”. The search period prioritized publications from 2022 to 2026, while foundational works in communicative competence, sociocultural theory, learner autonomy, writing theory, and self-regulation were retained when they provided the theoretical basis for the synthesis.

Documents were included when they met at least one of the following criteria: (a) direct relevance to GenAI in higher education; (b) application to foreign language learning, academic writing, oral production, ESP, or technical communication; (c) contribution to AI literacy, responsible AI, academic integrity, or assessment; (d) conceptual value for mediation, autonomy, agency, or communicative competence; or (e) institutional relevance as a policy or competency framework. Documents were excluded when they were primarily promotional, unrelated to higher education or language education, focused only on technical model performance without pedagogical implications, or duplicated findings already represented by more relevant sources. The final conceptual corpus comprised 48 documents, including peer reviewed articles, scholarly books, conceptual papers, and institutional frameworks or reports.

The analytical procedure involved three stages. First, the literature was mapped into thematic clusters: mediation and sociocultural theory, language production and communicative competence, learner autonomy and self-regulation, AI literacy and responsible use, academic writing and authorship, assessment, and engineering and technology communication. Second, conceptual tensions were identified across the clusters, especially the tension between assistance and substitution, fluency and ownership, personalization and dependence, and innovation and ethical accountability. Third, the MAICA Framework was formulated as a synthetic model that articulates these tensions into pedagogical dimensions and task design principles. The framework was then compared with relevant AI in education frameworks, including UNESCO’s AI competency frameworks, AI literacy frameworks, TEACH-RAI, TPACK with AI, and the AI Assessment Scale, to clarify its specific contribution. Because no human participants, personal data, or institutional records were used, ethical review was not applicable. Nevertheless, the article adopts a transparency principle by explicitly declaring the literature mapping procedure and the conceptual nature of its contribution.

4. Results

4.1 Conceptual tensions emerging from literature

The conceptual synthesis suggests that GenAI in foreign language education is shaped by four core tensions. The first tension is assistance versus substitution. AI can scaffold lexical search, grammar revision, idea generation, and rehearsal, but it may also perform the task instead of the learner. The second tension is fluency versus ownership. AI can produce fluent language, but fluency does not guarantee that the learner understands,

controls, or can reproduce the language. The third tension is personalization versus dependence. AI can provide individualized feedback, but permanent reliance may weaken strategic autonomy. The fourth tension is innovation versus accountability. Institutions may encourage innovative pedagogies, but teachers and students must still address privacy, authorship, transparency, and assessment fairness.

These tensions are not reasons to reject GenAI. There are design problems. In language education, the issue is no longer whether AI should be present. The more relevant question is how it should be positioned within learning tasks. A purely permissive approach may normalize outsourcing. A purely prohibitive approach may ignore students' actual practices and reduce opportunities for critical AI literacy. A pedagogical approach must therefore articulate legitimate uses, visible processes, reflective checkpoints, and assessment criteria that foreground communicative agencies.

Table 1 Theoretical anchors for the MAICA Framework

Theoretical anchor	Contribution to the article	Pedagogical implication
Sociocultural theory and scaffolding	Learning is mediated by tools, signs, interaction, and guidance.	GenAI should function as a scaffold within human mediation, not as an autonomous teacher.
Communicative competence	Language production involves grammatical, sociolinguistic, discourse, strategic, and pragmatic dimensions.	AI generated correctness must be complemented by interaction, adaptation, and communicative purpose.
Learner autonomy and self-regulation	Students need to plan, monitor, evaluate, and take responsibility for learning decisions.	AI use should develop strategic and critical autonomy rather than passive dependence.
AI literacy and responsible AI	AI users need to understand limitations, bias, hallucination, privacy, and authorship conditions.	Students should document prompts, verify output, declare assistance, and evaluate credibility.
Engineering communication and ESP	Professional communication requires clarity, precision, genre awareness, and ethical accountability.	GenAI tasks should connect language learning with technical genres, reports, presentations, and problem solving.

4.2 The MAICA Framework: Mediated AI Communicative Agency

The main conceptual contribution of this article is the MAICA Framework, a model for Mediated AI Communicative Agency. The framework proposes that responsible GenAI integration in foreign language education should be organized around five interdependent dimensions: pedagogical mediation, communicative production, disciplinary transfer, learner agency, and ethical and critical AI literacy (Figure 2). These dimensions define what teachers should design, what learners should practice, and what institutions should make visible in assessment policies. In Figure 2, pedagogical mediation is represented at the center as the fifth and organizing dimension, while communicative production, disciplinary transfer, learner agency, and ethical and critical AI literacy operate around it.

Pedagogical mediation is the organizing dimension. It refers to the teacher's role in defining objectives, setting boundaries, sequencing AI use, designing prompts, modeling verification, and assessing both process and product. Communicative production refers to the learner's oral and written performance, including drafting, rehearsing, revising, presenting, interacting, and adapting language to audiences. Disciplinary transfer connects language tasks to engineering and technology genres and professional situations. Learner agency emphasizes decision making, self-regulation, reflection, and ownership. Ethical and critical AI literacy requires students to understand what AI can and cannot do, identify inaccurate or biased output, protect privacy, and declare AI assistance transparently.

The framework rejects two extremes. It rejects technological determinism, which assumes that GenAI automatically improves learning. It also rejects defensive traditionalism, which treats AI only as a threat. Instead, the MAICA Framework argues that GenAI has pedagogical value when learners remain responsible for communicative intention, evidence, adaptation, and reflection. In practical terms, this means that a student may use AI to generate alternatives, receive feedback, rehearse a presentation, or improve a technical explanation, but the student must still be able to justify language choices, verify content, perform orally, and explain the learning process.

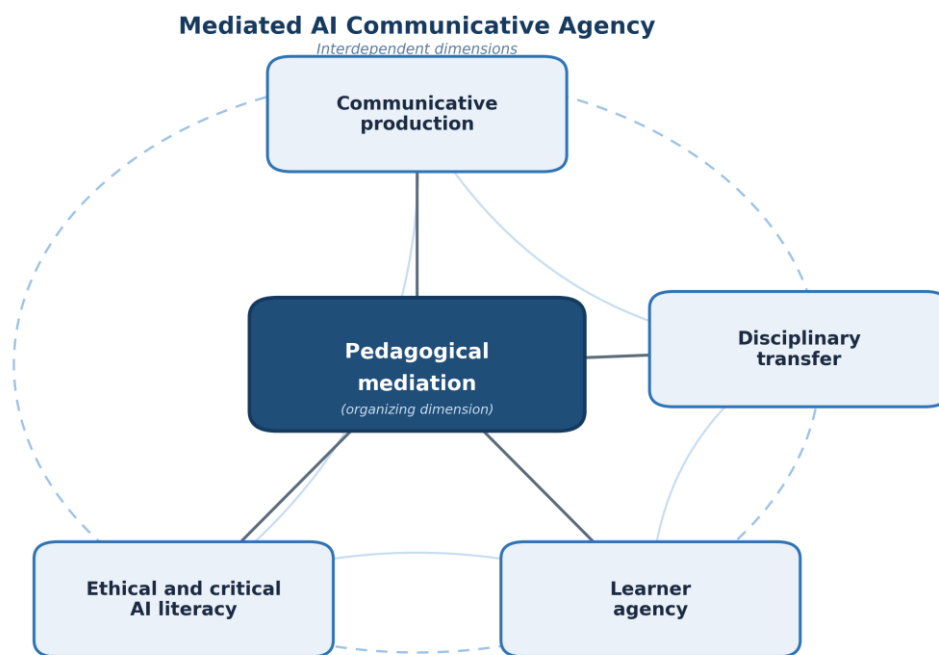


Figure 2 MAICA Framework: Mediated AI Communicative Agency. Pedagogical mediation is shown as the central fifth dimension

Table 2 Dimensions, risks, and safeguards of the MAICA Framework

MAICA dimension	Definition	Guiding question	Main risk	Pedagogical safeguard
Pedagogical mediation	Teacher planned guidance that situates AI use inside explicit learning objectives.	Why is AI being used in this task?	Unrestricted outsourcing	Provide specific task rules, modeling, rubrics, and process checkpoints.
Communicative production	Oral and written language performance oriented toward meaning, audience, and interaction.	Can the learner adapt and explain the language produced?	Polished but unowned output	Include oral defense, revision logs, and human interaction after AI supported preparation.
Disciplinary transfer	Connection between language learning and engineering and technology academic or professional genres.	How does this language task transfer to technical communication?	Generic AI responses	Use reports, prototypes, procedures, data explanations, and problem solving scenarios.
Learner agency	Student capacity to decide, monitor, evaluate, and take responsibility for AI assisted learning.	What decisions did the learner make beyond accepting AI output?	Dependence and reduced effort	Require comparison, justification, self assessment, and reflective commentary.
Ethical and critical AI literacy	Ability to use AI transparently, responsibly, and critically.	What was generated, modified, verified, and declared?	Hallucination, privacy issues, authorship ambiguity	Use AI use declarations, source verification, privacy rules, and integrity criteria.

4.3 An AI mediated communicative task cycle

The MAICA Framework can be operationalized through an AI mediated communicative task cycle (Figure 3). This cycle is designed for foreign language courses in engineering and technology programs in higher

education, but it can be adapted to other disciplinary contexts. The cycle begins with task orientation, where the teacher defines the communicative purpose, genre, audience, language objectives, and AI use boundaries. It then moves to guided prompting, where students learn to ask for support without transferring full responsibility to the tool. In the third stage, students draft or rehearse with AI assistance. In the fourth stage, they critically revise the output by checking accuracy, genre adequacy, disciplinary content, tone, and originality. In the fifth stage, they perform or submit the product with a transparent declaration of AI use. Finally, they complete a reflective transfer activity in which they identify what they learned and how they could apply the language independently in a new context.

This cycle transforms AI from a hidden shortcut into a visible learning process. It also supports assessment fairness because teachers can evaluate not only the final oral or written product, but also the student's decisions, revisions, explanations, and reflective ownership. For example, an engineering student preparing a short technical presentation may use GenAI to generate possible structures, practice transitions, and receive feedback on clarity. However, the student should then adapt the content to a real audience, verify technical terminology, rehearse orally, answer unscripted questions, and submit an AI use reflection. The final performance is therefore not the AI product; it is the student's communicative appropriation of AI supported preparation.

Table 3 AI mediated communicative task cycle

Stage	Learner action	Teacher mediation	Evidence for assessment
1. Task orientation	Identify audience, genre, communicative goal, and expected language functions.	Explain objectives, ethical rules, and acceptable AI support.	Task plan or brief.
2. Guided prompting	Use AI to request examples, vocabulary, feedback, or rehearsal support.	Model prompts that ask for scaffolding rather than complete substitution.	Prompt log.
3. Drafting or rehearsal	Produce an initial text, dialogue, explanation, or presentation outline.	Encourage comparison between learner output and AI suggestions.	First draft, recording, or rehearsal notes.
4. Critical revision	Verify accuracy, adapt language, correct problems, and reject unsuitable output.	Provide criteria for content verification, genre adequacy, and communicative ownership.	Revision log with explanations.
5. Transparent submission or performance	Submit or perform the final product and declare AI assistance.	Assess product and process using explicit criteria.	Final text or oral performance plus AI use declaration.
6. Reflective transfer	Explain what was learned and how it can be used without AI in a new situation.	Guide metacognitive reflection and future goal setting.	Short reflection or oral defense.

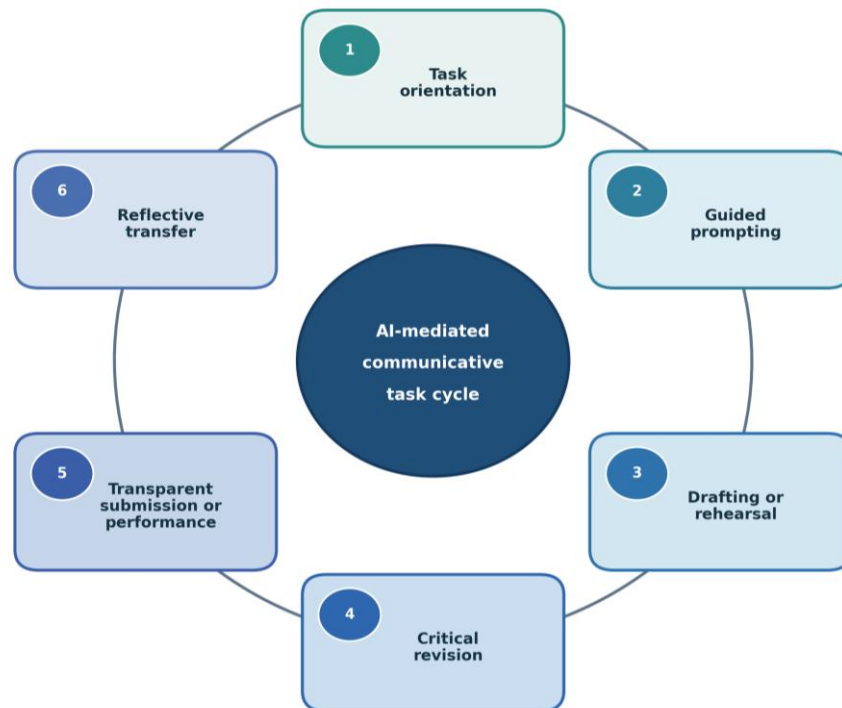
From guided AI support to independent transfer

Figure 3 The AI mediated communicative task cycle

5. Discussion

5.1 Contribution to educational practices and engineering

The MAICA Framework contributes to educational practices in engineering and technology programs by reframing GenAI as a communicative and ethical mediation system rather than as a productivity device. This distinction matters because engineering education often values efficiency, optimization, and technical problem solving. While these values are legitimate, language education must also cultivate interpretive judgment, rhetorical responsibility, and ethical authorship. A student who uses AI to write a technical report more quickly has not necessarily developed the capacity to communicate technical knowledge. Development occurs when the student understands the genre, evaluates the language, verifies the content, adapts the message, and can explain the process.

For language courses serving students in engineering and technology programs, the framework suggests that AI supported tasks should be anchored in disciplinary communication. Instead of asking learners to write generic essays or rehearse isolated dialogues, teachers can design tasks such as explaining a laboratory procedure, presenting a sustainable design, writing a technical incident report, comparing two engineering solutions, preparing a conference abstract, or simulating a client meeting. GenAI can assist with vocabulary, organization, and feedback, but the task should require verification, audience adaptation, and reflective ownership. This approach aligns with ESP principles and responds to the increasing need for multilingual professional communication in globalized technical fields (Rosandić, 2026; Sinkus & Ozola, 2024).

The framework also supports faculty development. Teachers may feel pressure to adopt AI quickly without a clear pedagogical rationale. MAICA offers a manageable structure: before integrating AI, teachers can ask whether the activity promotes mediation, production, transfer, agency, and ethical and critical literacy. If one dimension is absent, the activity can be redesigned. For example, a writing correction task may strengthen linguistic accuracy but fail to develop agency if students only accept AI suggestions. A speaking rehearsal task may improve fluency but fail ethically if students hide AI scripting. The framework therefore functions as a diagnostic tool for task design.

5.2 Positioning MAICA in relation to existing AI education frameworks

The MAICA Framework is not intended to replace broader AI policy, competency, or literacy frameworks. Its contribution is narrower and more pedagogically situated: it translates general principles of AI competence, responsible AI, and AI enhanced pedagogy into foreign language tasks where oral and written production, teacher mediation, disciplinary transfer, and communicative ownership must be designed and assessed together.

Table 4. Positioning MAICA in relation to existing AI education frameworks

Framework or model	Core orientation	Specific contribution of MAICA
UNESCO guidance and AI competency frameworks (Miao & Holmes, 2023; UNESCO, 2024; Miao et al., 2024)	Human centered AI use, ethics, AI foundations, pedagogy, professional learning, and student agency.	Operationalizes these principles within language tasks by connecting ethical AI use with communicative production, teacher mediation, and disciplinary transfer.
AI literacy frameworks (Long & Magerko, 2020; Digital Education Council, 2025)	Understanding AI and data, critical evaluation, responsible use, human centered skills, and domain expertise.	Narrows AI literacy to visible language learning practices: prompt documentation, output verification, revision decisions, oral or written ownership, and reflective transfer.
TEACH-RAI (Ding & Magerko, 2026)	A bridge between responsible AI principles and AI literacy through an educational design checklist.	Adds a foreign language and ESP perspective, emphasizing communicative agency, technical genres, audience adaptation, and assessment evidence.
TPACK with AI and intelligent TPACK (Celik, 2022; Tan et al., 2025)	Teacher knowledge for ethical integration of AI tools across technology, pedagogy, and content.	Places teacher knowledge inside a task cycle where learners must plan, revise, declare, defend, and transfer AI supported language production.
AI Assessment Scale (Perkins et al., 2024)	Transparent levels of acceptable GenAI use in assessment design.	Complements assessment levels with language specific process evidence such as prompt logs, revision commentaries, oral defenses, and reflective transfer.

Compared with these frameworks, MAICA foregrounds three elements that are often treated separately in the broader AI education literature. First, it treats GenAI use as a matter of communicative agency, not only as digital competence or academic integrity. Second, it links AI mediated language practice to disciplinary transfer in engineering and technology programs, where precision, audience awareness, and accountability are central. Third, it makes assessment evidence explicit by requiring learners to show how AI support was requested, evaluated, modified, declared, and transferred to independent language use. In this sense, MAICA contributes a language specific bridge between AI literacy, responsible AI, ESP, and process focused assessment.

5.3 Assessment implications

Assessment is the most fragile area of GenAI integration. Traditional product focused assessment becomes insufficient when students can use AI to produce grammatically polished language. This does not mean that product quality is irrelevant, but it does mean that product quality must be interpreted alongside process evidence. In foreign language education, teachers should assess what students can do with language, what decisions they make, how they revise, how they respond to feedback, and how they transfer learning to new contexts. Process focused assessment also reduces the temptation to rely exclusively on AI detectors, which are technically limited and pedagogically narrow.

The MAICA Framework suggests several assessment practices. First, teachers can require prompt logs and AI to use declarations, as learning evidence rather than bureaucratic requirements. Second, students can submit revision commentaries explaining what they accepted, modified, or rejected from AI suggestions. Third, written products can be accompanied by short oral defenses in which learners explain vocabulary choices, argument structure, or technical content. Fourth, speaking tasks can include unscripted subsequent questions to evaluate communicative flexibility. Fifth, rubrics can include ethical transparency and reflective agency as explicit criteria. These practices make AI use visible and educational rather than hidden and punitive.

Assessment should also recognize different levels of legitimate AI support. At early language levels, AI may help learners understand instructions, generate vocabulary lists, or model sentence patterns. At intermediate levels, AI can support organization, revision, and rehearsal. At higher levels, students can critique AI output, identify rhetorical limitations, verify evidence, and improve disciplinary precision. The ethical issue is not the

mere presence of AI but the absence of use that is declared, aligned with learning goals, and pedagogically meaningful.

5.4 Risks, limitations, and safeguards

The proposed framework does not assume that GenAI is neutral or inherently beneficial. Several risks remain. First, hallucination and fabricated sources are particularly dangerous in academic and technical contexts. Second, AI output may reproduce biases or offer culturally generic language that weakens pragmatic competence. Third, students may become dependent on AI for lexical, grammatical, or organizational decisions. Fourth, unequal access to paid tools may create fairness issues. Fifth, teachers may lack training in AI literacy and may therefore either prohibit tools without guidance or allow them without structure.

These risks require safeguards at the institutional, pedagogical, and learner levels. Institutions should provide clear policies, privacy guidance, and faculty development. Teachers should design tasks that require process evidence, verification, and reflection. Students should learn to use AI as a support for learning, not as an invisible substitute for thinking or communication. Safeguards should also include technologically simple alternatives, transparent criteria, and discussion of data privacy. For engineering and technology learners, additional safeguards should address technical accuracy, source verification, and the ethical consequences of communicating unreliable information.

This article is limited by its conceptual design. It does not validate the MAICA Framework through classroom implementation or empirical measurement. Future research should apply the framework in foreign language courses for students in engineering and technology programs, collect learner reflections, compare written and oral performance before and after AI mediated tasks, and examine how transparent AI use declarations affect autonomy and academic integrity. Longitudinal studies are particularly necessary because the immediate benefits of AI support may differ from its sustained effects on independence, language ownership, and communicative confidence.

6. Conclusions

GenAI is transforming the conditions under which university students plan, write, rehearse, revise, and communicate in foreign languages. In engineering and technology programs in higher education, this transformation is especially significant because students need language not only for academic success but also for technical collaboration, professional mobility, and responsible participation in global knowledge communities. The central challenge is therefore not to decide whether GenAI belongs in language education, but to determine how it can be integrated without weakening authorship, autonomy, communicative competence, and ethical responsibility.

This article proposed the MAICA Framework as an ethical and pedagogical model for GenAI integration in foreign language education. The framework argues that AI should be mediated through five dimensions: pedagogical mediation, communicative production, disciplinary transfer, learner agency, and ethical and critical AI literacy. It also proposed an AI mediated communicative task cycle that makes AI use visible through orientation, guided prompting, drafting or rehearsal, critical revision, transparent submission or performance, and reflective transfer.

The main conclusion is that GenAI can support foreign language learning only when its use is pedagogically bounded, ethically declared, and communicatively appropriated by learners. A polished AI assisted text is not evidence of learning unless the student can understand, adapt, verify, perform, and transfer it. Similarly, AI supported speaking practice becomes educational only when it leads to human interaction, flexibility, and increased communicative confidence. For educators, the task ahead is not to compete with AI, but to design learning environments where AI becomes an object of critical mediation and a scaffold for human communicative agency.

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