Journal of Inclusive Methodology and Technology in Learning and Teaching
ISSN 2785-5104
Anno 6 n. 1 (2026)

EDIZIONI UNIVERSITARIE ROMANE
editoria scientifica dal 1952

Prompt Literacy for teachers: a progressive Pedagogical Framework for AI-Enabled Inclusive Learning

Francesco Facciorusso [1], Paola Alessia Lampugnani [2], Maria Concetta Carruba [2], Marilena di Padova [3], Marika Lamacchia [1], Anna Dipace [2]* [1]

[1] Università degli studi di Macerata; f.facciorusso@unimc.it; m.lamacchia2@unimc.it
[2] Università Telematica Pegaso; paolaalessia.lampugnani@unipegaso.it; mariaconcetta.carruba@unipegaso.it; anna.dipace@unipegaso.it;
[3] Università degli studi di Foggia; marilena.dipadova@unifg.it;
* Correspondence: f.facciorusso@unimc.it

Abstract: This study presents a structured development model aimed at transforming prompt engineering from a technical skill into a core pedagogical competency for Italian secondary school teachers. Despite the increasing integration of artificial intelligence (AI) in educational settings, significant gaps persist in teacher AI literacy, with only 34% of Italian educators feeling adequately prepared to use AI tools (GoStudent, 2025). This study addresses this critical deficit by proposing a progressive three-level "prompt literacy" framework grounded in the UNESCO AI Competency Framework for Teachers and Universal Design for Learning (UDL) 3.0 principles. The model defines three competency stages (Basic Prompt Literacy, Pedagogical Prompting, and Inclusive Prompt Design) aligned with UNESCO's Acquire-Deepen-Create progression levels. Each stage integrates the Prompt Engineering Competence Scale (PECS) for self-assessment and competency measurement. Through situated, practice-based workshops, teachers learn to design prompts that support multiple means of representation, engagement, and expression, thereby creating inclusive, adaptive, and student-centered learning environments. By bridging the AI literacy gap with pedagogically informed prompt design strategies, this framework aims to empower educators to leverage AI as a tool for equity and meaningful differentiation in contemporary classrooms.

Keywords: prompt engineering, teacher professional development, AI Literacy.

1. Introduction

The rapid integration of artificial intelligence in educational settings presents both significant opportunities and notable challenges for contemporary teaching practice. While generative AI technologies offer promise for personalization, accessibility, and inclusive learning design, their effective implementation depends

[1] The article is the result of a joint work of the six authors. The Introduction (paragraph 1) was written by Anna Dipace. Paragraph 2 (Prompt Engineering in Educational Contexts) was written by Marilena di Padova. Paragraph 3 (From Technical Skill to Pedagogical Competence) was written by Maria Concetta Carruba. Paragraph 4 (Prompt Literacy for Teachers: the Framework) was written by Francesco Facciorusso. Paragraphs 5 (Limitations and future research) was written by Marika Lamacchia. Conclusions (paragraph 6) was written by Paola Alessia Lampugnani.

EDIZIONI UNIVERSITARIE ROMANE
editoria scientifica dal 1952

fundamentally on teachers' capacity to engage critically, pedagogically, and ethically with these tools (UNESCO, 2024; Holmes et al., 2019). In particular, the emergence of prompt engineering, the skill of designing structured and purposeful inputs to guide AI systems, has introduced a new layer of digital and pedagogical literacy that teachers must acquire. However, despite its growing importance, prompt engineering remains an underexplored area in teacher education, often misunderstood as a purely technical skill rather than a pedagogical one (Gibreel, O. & Arpaci, I., 2025). This paper reconceptualizes prompt engineering as prompt literacy—a pedagogically grounded framework that situates this skill within broader teaching and learning practices.

In Italy, the recent Ministerial Guidelines on Artificial Intelligence in Schools (MIM, 2025) have formally institutionalized AI integration into teaching and learning, establishing three organizing principles: the preservation of human pedagogical agency, transparent and ethically grounded technology use, and the design of inclusive, student-centered learning environments. Yet this progressive policy framework exists in tension with substantial implementation. A recent Italian Report about education's future states that only 34% of secondary school teachers report feeling adequately prepared to integrate AI into instruction; despite a lack of training, 58% of teachers in Italy believe AI will be central to their students' professional lives. (GoStudent, 2025). This mismatch between policy intent and teacher readiness constitutes a critical gap that requires systematic, theoretically grounded professional development.

This study proposes Prompt Literacy for Teachers (PLT), a progressive, three-stage professional development framework that operationalizes prompt engineering as a core pedagogical competence rather than a peripheral technical skill. The framework integrates three foundational elements:UNESCO AI Competency Framework for Teachers (AI CFT), which establishes competency progression across foundational, intermediate, and advanced levels; Universal Design for Learning 3.0 (UDL), which centers learner variability and equitable access; Prompt Engineering Competence Scale (PECS), a validated instrument for measuring prompt literacy development.

The model defines three developmental stages—Basic Prompt Literacy (Acquire), Pedagogical Prompting (Deepen), and Inclusive Prompt Design (Create), aligned with UNESCO's progression taxonomy. By grounding prompt engineering in pedagogical theory and inclusive design principles, this framework bridges the policy-practice gap while positioning teachers as informed designers of AI-mediated learning rather than passive technology consumers. This paper contributes to the emerging field of AI-literacy teacher education by: reconceptualizing prompt engineering as a pedagogical competence, providing an operationalized model for competency development, offering empirical measurement tools through PECS adaptation, and demonstrating alignment with Italian regulatory mandates and international best practice frameworks.

EDIZIONI UNIVERSITARIE ROMANE
editoria scientifica dal 1952

2. Prompt Engineering in Educational Contexts

Prompt engineering (PE) is defined as the deliberate design of structured inputs—comprising explicit instructions, contextual information, input data, and desired output specifications—to elicit accurate, relevant, and pedagogically aligned responses from AI systems (Federiakin, D. et al., 2024). In traditional digital literacy frameworks, PE might be treated as a technical optimization skill. However, in educational contexts, PE extends significantly beyond technical input formatting to encompass what researchers term pedagogical prompting: the strategic design of prompts that guide AI systems to generate responses aligned with evidence-based instructional strategies suited to specific learner needs (Xiao et al., 2025).

Interventionary studies involving animals or humans, and other studies that require ethical approval, must list the authority that provided approval and the corresponding ethical approval code. The emergence of large language models (LLMs) has introduced a new dimension of digital literacy that educators must acquire to effectively integrate artificial intelligence into teaching practices. A pedagogically crafted prompt may instruct the AI to present worked examples, engage learners with reflective questions, or scaffold problem-solving processes in accordance with established learning science principles such as the Knowledge-Learning-Instruction (KLI) framework (Koedinger K., Corbett A., & Perfetti C., 2012).

A pedagogical prompt differs fundamentally from general prompts in that it intentionally directs the AI model to act as a tutor, generating outputs that facilitate appropriate learning activities rather than simply providing direct answers. A technical prompt might read: "Summarize photosynthesis." A pedagogical prompt, by contrast, explicitly directs cognitive engagement: "Explain photosynthesis step-by-step as if teaching a 9th-grade student who struggles with abstract concepts. Use a concrete analogy, pose a reflective question, and avoid technical jargon initially." This pedagogical iteration intentionally constrains the AI to act as an instructional partner, scaffolding learning rather than providing direct answers

2.2 Structural Elements of Effective Prompts

We can summarize the structure of an effectively written teaching package by following the following four elements (di Padova, M. & Lotti, A., 2024; Chang K. et al., 2024; Giray L., 2023):

- Instruction: a specific task guiding the model's behavior;
- Context: background information enabling relevant responses;
- Input data: the content requiring processing;
- Output indicator: specifications for the desired format and type of response.

In pedagogical applications, these elements are augmented by learner-level

EDIZIONI UNIVERSITARIE ROMANE
editoria scientifica dal 1952

specification, difficulty identification, and guardrails that constrain the AI from providing direct solutions, thus preserving opportunities for authentic learning (Xiao et al., 2025).

2.3 Empirical Evidence on Prompt Engineering Effectiveness

Research demonstrates that prompt engineering, when mastered by educators, yields significant benefits across multiple dimensions of teaching practice. First, PE enables adaptive, student-centered instruction at scale. According to OECD data, teachers employing AI strategically for instructional planning reported saving up to 30% of preparation time, thereby freeing capacity for direct student support (OECD, 2023). Second, well-crafted prompts facilitate the creation of differentiated learning materials, multiple representations of content at varying complexity levels, alternative formats for learners with special needs, and personalized feedback mechanisms aligned with Universal Design for Learning principles (Teague, 2025; CAST, 2024).

The iterative process of constructing, testing, and refining prompts cultivates metacognitive awareness in both teachers and students, supporting higher-order thinking skills including problem decomposition, abstraction, and critical evaluation (Federiakin et al., 2024). A systematic review of prompt engineering applications in K-12 STEM education identified that advanced techniques such as Chain-of-Thought prompting and few-shot learning produced positive outcomes across diverse educational tasks, particularly when educators possessed adequate PE training (Pimentel, Gardner, & Price, 2024).

3. From Technical Skill to Pedagogical Competence

The reconceptualization of prompt engineering from a technical practice to a core pedagogical competence represents a significant epistemological shift, with important implications for teacher education and professional development.

3.1 Prompt Engineering as a Multidimensional Competence

Early approaches to prompt engineering treated it as a collection of "tips and tricks" for optimizing AI outputs—manipulating language, adjusting specificity, or employing formatting hacks (Giray, 2023). Contemporary frameworks recognize a more sophisticated structure: prompt engineering as a multidimensional competence encompassing four integrated dimensions (Federiakin et al., 2024): Comprehension of AI Systems: understanding how LLMs process information, their constraints, and their affordances; Prompt Formulation Literacy: precision and clarity in articulating problems, contexts, and desired solutions; Pedagogical Prompting Methods: strategic techniques (Chain-of-Thought, few-shot learning, role-playing) aligned with learning science principles; Critical Online Reasoning: evaluation, fact-checking, and adaptation of AI-generated content for educational appropriateness.

This composite structure aligns with established 21st-century skills frameworks while addressing the unique affordances and challenges of generative AI.

3.2 Implications for Teacher Education

Positioning prompt engineering as a pedagogical competence rather than a technical skill reframes its role in teacher education. Instead of situating PE training in computer science or IT professional development, prompt literacy becomes a core component of pedagogical methods courses, subject-area pedagogy, and professional learning communities. This reframing emphasizes that prompt design is an act of instructional design: it requires pedagogical reasoning, knowledge of how students learn, and commitment to equitable access, not merely technical proficiency (García-Beltrán E., 2026).

This conceptual reorientation has significant consequences: it positions the teacher, not the AI system, as the primary agent of instructional decision-making. The teacher's role becomes one of intelligent mediation—leveraging AI as a tool to amplify pedagogical intent while maintaining responsibility for learning outcomes, equity, and student agency.

4. Prompt Literacy for Teachers: the Framework

4.1 Theoretical Foundations and Design Principles

The Prompt Literacy for Teachers (PLT) framework is grounded in three foundational theoretical domains:

UNESCO AI Competency Framework for Teachers (AI CFT) provides a macro-level taxonomy of AI competencies organized across three progression stages: *Acquire* (foundational awareness and knowledge), *Deepen* (application to disciplinary contexts), and *Create* (innovation and design). This progression model ensures that teacher development is systematic, scaffolded, and aligned with international standards.

Universal Design for Learning 3.0 (UDL) establishes that learning environments should embed flexibility across three systems): multiple means of representation (how information is presented); multiple means of engagement (how students are motivated to learn); multiple means of action and expression (how students demonstrate understanding) (CAST, 2024).

Prompt literacy becomes the mechanism through which teachers operationalize UDL principles using AI.

Prompt Engineering Competence Scale (PECS) provides a validated, psychometrically sound instrument for measuring prompt engineering competence across multiple dimensions. Adaptation of PECS to the Italian context enables empirical tracking of teacher development (Gibreel, O., & Arpaci, I. (2025).

4.2 The Three Stages of Prompt Literacy

At the Basic Prompt Literacy level (Acquire), teachers develop foundational awareness of AI systems, ethical considerations in AI use, and basic competence in

structuring clear, contextually relevant prompts. This stage emphasizes these competencies: understand how LLMs function, their capabilities, and their limitations, recognize ethical, transparency, and bias considerations when using AI in education, articulate learning objectives clearly and identify what information AI requires, structure prompts using the four-element model (Instruction, Context, Input, Output), evaluate AI outputs for accuracy, bias, and educational appropriateness.

Teachers analyze exemplary prompts, identify structural elements, and construct basic prompts for their discipline. Emphasis is placed on maintaining pedagogical agency, understanding that AI is a technological tool that amplifies, not replaces, teacher decision-making.

The Pedagogical Prompting level (Deepen) elevates prompt engineering to an instructional strategy: teachers learn advanced prompting techniques that operationalize evidence-based instructional strategies, enabling AI to scaffold student reasoning, provide differentiated feedback, and generate varied learning materials. Here, teachers learn some of these competencies: design prompts using Chain-of-Thought techniques to scaffold problem-solving; employ few-shot learning within prompts to guide AI toward specific examples; create role-based prompts positioning AI as tutor, mentor, or learning partner; design prompts that generate multiple representations of content (visual, textual, analogical); craft feedback prompts aligned with formative assessment principles.

Teachers work in discipline-specific cohorts, addressing real instructional problems: "My students struggle with the multi-step nature of the scientific method—design a prompt that scaffolds this." Peer collaboration and iterative refinement are central.

Ultimately, the Inclusive Prompt Design (Create) layer represents the model's most innovative contribution, positioning teachers as architects of equitable learning ecosystems. Advanced practitioners develop prompt models that proactively address student variability, generating accessible materials for students with dyslexia, multilingual resources for second language learners, and personalized supports for different cognitive profiles, directly implementing UDL 3.0's emphasis on student agency and the removal of barriers (Rose, D. H. et al., 2024; CAST, 2024). This layer fosters teachers' ability to coordinate multiple AI-generated resources into personalized and inclusive learning paths that meet diverse student needs; teachers work in cross-disciplinary teams to develop "prompt libraries"—curated, reusable prompt templates addressing specific inclusive design challenges. Implementation in real classrooms with student feedback loops.

4.3 Integration of the Prompt Engineering Competence Scale (PECS)

The Prompt Engineering Competence Scale (PECS) provides a validated 9-item instrument measuring prompt engineering competence across dimensions including comprehension, formulation, methods, and critical reasoning. Within the PLT framework, PECS serves three functions (Gibreel, O., & Arpaci, I., 2025):

- Self-Assessment Tool: teachers complete PECS items at stage entry and

completion, tracking their perceived competency growth;
- Measurement Instrument: researchers use PECS to evaluate intervention effectiveness and identify areas requiring additional support;
- Feedback Mechanism: PECS data informs adaptive professional development—teachers demonstrating lower comprehension scores receive additional conceptual support.

The PLM demonstrates how UNESCO's broad AI competencies can be operationalized through domain-specific skills. By integrating prompt literacy with UDL principles, the model validates AI's potential as an amplifier of inclusive pedagogy—provided teachers possess the design literacy to direct AI purposefully and ethically (Kolhatin, A. O. 2025). PLM implementation could address Italian teachers who report inadequate AI preparation, fostering systemic improvement in classroom equity and inclusive instruction.

In future research, comparative analyses across different national contexts would illuminate how culturally-specific adaptations of the framework enhance its applicability. By bridging policy intent, theoretical rigor, and classroom practice, the Prompt Literacy Model offers a model for human-centered AI integration in education, one that positions teachers as informed, thoughtful mediators of technology rather than passive implementers.

5. Limitations and future research

While this study presents a systematic framework for integrating prompt literacy into Italian secondary education, several methodological and contextual limitations warrant acknowledgment. The quasi-experimental design employed, though appropriate for naturalistic educational settings where randomization is neither feasible nor ethical, constrains the generalizability of findings to other Italian regions and educational systems (Gopalan et al., 2020). The non-random assignment of participating schools, while reflecting authentic implementation conditions, introduces potential confounding variables related to school socioeconomic status, digital infrastructure, and teacher motivation that cannot be fully controlled. Additionally, the PECS instrument's recent adaptation to the Italian context requires longer-term validation across diverse school populations to confirm its psychometric reliability and cultural sensitivity in non-English-speaking educational contexts.

The study's cross-sectional observation periods limit our ability to assess the sustained impact of prompt literacy training beyond the intervention timeline. Since the fast-paced evolution of AI technologies requires educators to maintain continuous professional development , longitudinal research tracking teachers' competency trajectories over multiple academic years would provide crucial evidence regarding skill retention and transfer to novel AI applications (Walter Y., 2024). Furthermore, the research focuses primarily on teacher competency development with limited empirical data on direct student learning outcomes, particularly for underserved populations. While the Inclusive Prompt Design level theoretically supports equitable learning experiences through UDL-aligned

strategies, longitudinal studies examining the causal relationship between prompt literacy and student achievement, engagement, and equity would strengthen claims about the model's transformative potential.

The geographic and institutional scope of the Italian context, while providing valuable insights into policy-practice alignment with the D. M. 166/2025, may not translate directly to other European educational systems with different regulatory frameworks, technological affordances, and teacher preparation traditions. Comparative investigations across countries differing in AI infrastructure development, language and cultural pedagogical values, and policy maturity would illuminate how contextually specific adaptations enhance the PLM's applicability. On the other hand, this study does not extensively examine the role of organizational factors—including school leadership support, resource allocation for ongoing training, and technical infrastructure, that empirical research suggests are critical moderators of successful technology integration (Darling-Hammond I. et al., 2017). Future implementations should incorporate organizational readiness assessments and multi-level analysis to better understand how institutional context shapes the effectiveness of prompt literacy interventions.

These limitations suggest several productive directions for future research. Longitudinal studies with larger, more geographically diverse samples should track both teacher professional growth and measurable student outcomes across cognitive, affective, and equity domains. Mixed-methods research combining quantitative competency measurement through PECS with qualitative investigations of how teachers enact prompt literacy in discipline-specific contexts would deepen understanding of pedagogical transfer. Additionally, experimental or quasi-experimental designs comparing the PLM against alternative approaches to AI teacher training would provide stronger evidence of relative effectiveness. Further empirical investigations into the convergence of digital literacy and emerging teacher competencies – such as AI ethics and critical data literacy – could generate integrative frameworks for continuing teacher education in the context of an increasingly AI-mediated pedagogy.

6. Conclusions

The rapid integration of artificial intelligence into educational systems represents both significant opportunity and substantial risk. The opportunity lies in AI's capacity to personalize learning at scale, to amplify teacher effectiveness, and to create more accessible, equitable learning environments. The risk lies in uncritical adoption that reproduces existing inequities, outsources pedagogical judgment, and treats technology as solution rather than tool.

This work argues that the path toward beneficial, equitable AI integration in education passes through teacher competency and professional agency, specifically, through development of the pedagogical and design literacy that enables teachers to direct AI toward genuine educational benefit. The Prompt Literacy for Teachers framework offers one structured pathway toward this goal. The fundamental insight is simple but profound: Teachers with prompt literacy are not at risk of being replaced by AI. Rather, they become more capable of directing AI toward equitable,

student-centered, intellectually rich learning experiences. They maintain and expand their professional authority in an increasingly technology-mediated landscape.

Prompt literacy transforms the question from "How can AI replace teachers?" to "How can teachers use AI to become more effective educators of all students?" Prompt literacy transforms the question from "How can AI replace teachers?" to "How can teachers use AI to become more effective educators of all students?". This is the antidote to technological determinism: not resistance to technology, but competence in directing it toward humane educational purposes. Prompt literacy empowers teachers to answer the rephrased question not with hope, but with evidence and professional agency. This research contributes an evidence-based answer to that question—and paves the way for teachers to write many more.

References

CAST (2024). Universal Design for Learning Guidelines version 3.0 [graphic organizer]. Lynnfield, MA.

Chang, K., Xu, S., Wang, C., Luo, Y., Liu, X., Xiao, T., & Zhu, J. (2024). *Efficient prompting methods for large language models: A survey*. arXiv preprint arXiv:2404.01077

di Padova, M., Lotti, A. (2024). Progettazione didattica e Intelligenza Artificiale generativa per una scuola digitale e inclusiva. Roma: Tab Edizioni

Darling-Hammond, L., Hyler, M. E., & Gardner, M. (2017). Effective Teacher Professional Development. Research Brief. *Learning Policy Institute*. https://doi.org/10.54300/122.311

Federiakin, D., Molerov, D., Zlatkin-Troitschanskaia, O., & Maur, A. (2024). Prompt engineering as a new 21st century skill. *Frontiers in Education, 9*, 1366434. https://doi.org/10.3389/feduc.2024.1366434

García-Beltrán, E. (2026). No es magia, es prompting: el diseño de prompts como competencia emergente en la formación docente. Un estudio desde el modelo CRETA+R [It's Not Magic, It's Prompting: Prompt Design as an Emerging Competence in Teacher Education. A Study Based on the CRETA+R Model]. Pixel-Bit, Revista de Medios y Educación, 75, Art. 6. https://doi.org/10.12795/pixelbit.115487

Gibreel, O., & Arpaci, I. (2025). Development and validation of the prompt engineering competence scale (PECS). *Information Development*, *0*(0). https://doi.org/10.1177/02666669251336455

Giray, L. (2023). Prompt engineering with ChatGPT: A guide for academic writers. *Annals of Biomedical Engineering, 51*, 2629–2633. https://doi.org/10.1007/s10439-023-03272-4.

Gopalan, M., Rosinger, K., & Ahn, J. B. (2020). Use of Quasi-Experimental Research Designs in Education Research: Growth, Promise, and Challenges. *Review of Research in Education*, 44, 218-243. https://doi.org/10.3102/0091732X20903302

GoStudent. (2025). *Report GoStudent sul futuro dell'istruzione 2025*. https://www.gostudent.org/static/documents/it-it/report-istruzione/2025.pdf

Guo, P., Wang, Z. (2025). Implementation fidelity of universal design for learning and effects on student achievement engagement and belonging. *Sci Rep* 15, 45430. https://doi.org/10.1038/s41598-025-30079-1

Holmes, W., Porayska-Pomsta, K., Holme, T., & Bower, M. (2019). Artificial intelligence in education: Promise and implications for teaching and learning. OECD Education Working Papers.

Koedinger, K. R., Corbett, A. T., & Perfetti, C. (2012). The Knowledge-Learning-Instruction framework: Bridging the science-practice chasm to enhance robust student learning. *Cognitive Science, 36*(4), 757–798. https://doi.org/10.1111/j.1551-6709.2012.01245.x

Kolhatin, A. O. (2025). A human-centered framework for generative AI in adaptive educational content creation. *Proceedings of the 8th International Workshop on Augmented Reality in Education (AREdu 2025)*, co-located with the 6th International Conference on History, Theory and Methodology of Learning (ICHTML 2025) (CEUR Workshop Proceedings Vol. 4060, pp. 143–159). CEUR-WS.org.

Ministero dell'istruzione e del merito (MIM). (2025). *Linee guida per l'introduzione dell'Intelligenza Artificiale nelle Istituzioni scolastiche*. https://www.mim.gov.it/documents/8099600/8784171/MIM_Linee+guida+IA+nella+Scuola_09_08_2025-signed.pdf/4bfecbc5-70e1-2973-940f-1aa818a9f3f6?version=1.0&t=1757064111486.

OECD. (2023). *PISA 2025 SCIENCE FRAMEWORK*. Paris: OECD Publishing.

OECD. (2023). *OECD Digital Education Outlook 2023: Opportunities, guidelines and guardrails for effective and equitable use of AI in education*. OECD Publishing.

Pimentel, M., Gardner, J., & Price, T. (2024). A systematic review on prompt engineering in large language models for K-12 STEM education. arXiv preprint arXiv:2410.11123.

Rose, D. H., Meyer, A., & Hitchcock, C. (2024). *Universal Design for Learning: Theory and practice* (3rd ed.). CAST Publishing.

Teague, H. (2025). 10-Rep Learning: Generative AI Prompts for DI and UDL. *Edublogs*. https://4oops.edublogs.org/2025/07/23/ai-prompts4diandudl/

UNESCO. (2024). *AI Competency Framework for Teachers*. Paris: UNESCO. https://doi.org/10.54675/ZJTE2084

Walter, Y. (2024) Embracing the Future of Artificial Intelligence in the Classroom: The Relevance of AI Literacy, Prompt Engineering, and Critical Thinking in Modern Education. *International Journal of Educational Technology in Higher Education*, (21), 15. https://doi.org/10.1186/s41239-024-00448-3

Xiao, R., Hou, X., Ye, R., Kazemitabaar, M., Diana, N., Liut, M., & Stamper, J. (2025). *Improving student-AI interaction through pedagogical prompting: An example in computer science education*. https://arxiv.org/abs/2506.19107.