# Prompt Engineering as an AI Literacy Competence: A Framework for Learners and Educators

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**Abstract.** As generative artificial intelligence (GenAI) tools such as ChatGPT, Gemini, and Copilot increasingly enter educational settings, the ability of educators and learners to interact with these systems meaningfully becomes a critical competence. This paper positions prompt engineering - the practice of formulating effective inputs to guide AI outputs - as a foundational skill within the broader concept of AI literacy for educators and learners. This paper suggest a conceptual framework that connects prompt engineering with existing models of AI literacy and examines its relevance for pedagogical design, content generation, feedback, and student interaction. We synthesize recent literature on prompt typologies, outline key dimensions of competence (cognitive, technical, ethical), and propose a structure for integrating prompt engineering into learners' and educators' professional development. By treating prompt engineering as a form of literacy rather than technical know-how, we argue for its central place in future educational practices and policies to enable a smart society in which learners and educators effectively use generative AI.

**Keywords:** Prompt Engineering; AI literacy; Generative Artificial Intelligence; ChatGPT.

## 1 Introduction

The integration of GenAI tools such as ChatGPT, Copilot, and Gemini into educational practice is no longer a matter of future potential - it is an active transformation already underway. These tools are increasingly used to generate content, assist in the automation of assessment feedback, support student inquiry, and even assist in curriculum design. As their presence grows, so does the demand for learners and educators to understand and use them effectively and responsibly. This evolution in educational technology calls for a shift in focus from general digital literacy toward a more specific set of competencies known as AI literacy. AI literacy is commonly defined as the capacity to critically understand, use, and evaluate AI systems in varied contexts [1]. Recent frameworks extend this to generative AI, highlighting the importance of discerning tool selection, prompting strategies, and ethical evaluation of

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AI-generated content [2]. Within this broader framework, prompt engineering - the art and practice of formulating effective and purposeful inputs for large language models (LLMs) - emerges as a foundational skill. While often discussed in technical or developer contexts, prompt engineering is increasingly relevant in pedagogical settings, where the quality of an educator's or learner's prompts can significantly influence the relevance, clarity, and ethical integrity of AI-generated content. Recent research emphasizes this relation. [3] demonstrate that a high level of AI literacy among educators directly impacts the success of prompt engineering strategies in learning environments. Their work supports the argument that prompt engineering is not merely a matter of syntax or tool mastery, but rather a pedagogical and epistemic skill that requires educators to understand the affordances, risks, and limitations of AI systems. Despite its growing importance, prompt engineering is not yet systematically addressed in existing learners' or educators' training programs or AI literacy frameworks. Most users encounter these tools without formal guidance, learning through trial and error or relying on templates of uncertain pedagogical value. This lack of structure presents both a challenge and an opportunity: to define prompt engineering as a core element of educators' AI literacy.

This paper aims to provide a conceptual foundation for understanding prompt engineering as part of AI literacy in education. We synthesize existing literature, examine the cognitive, technical, and ethical dimensions of prompt use, and propose a framework for integrating prompt engineering into learners' and educators` development. The paper seeks to inform future curriculum design and policy initiatives, and to open space for critical discussion around the educator's evolving role in AI-mediated learning environments.

The structure of the paper is as follows: Section 2 explores the concept of AI literacy and positions prompt engineering within it. Section 3 outlines key educational applications and typologies of prompts. Section 4 introduces a conceptual framework for prompt engineering competence. Section 5 concludes the paper with recommendations for practice and directions for future research.

## 2 Theoretical Background

As AI technologies become increasingly embedded in everyday life, the concept of AI literacy has gained prominence as a critical component of digital competence. It encompasses not only technical understanding but also awareness of societal impacts, ethical considerations, and the capacity to make decisions in AI-mediated contexts. Recent frameworks have moved beyond narrow definitions of technical proficiency, emphasizing a holistic view of AI literacy to support individuals - especially educators and students - with the knowledge and skills to critically engage with AI-driven technologies across different settings [4]

AI literacy frameworks demonstrate three main structural approaches (component, competency, and perspective-based), consistently including technical and ethical components but rarely incorporating explicit measurement tools. AI literacy frameworks are developed for varied audiences (K–12, higher education, workforce, and citizens). Furthermore, such frameworks fall into distinct groups. For example, several studies (e.g., [5], [6]) use component or taxonomy-based models, whereas [7] focus on competency-based approaches. Others (e.g. [8], [9]) develop perspective-based frameworks. [9] propose a multidimensional ABCE model with an explicit 32-item assessment tool. That is one out of only few studies (e.g. [10].) integrating clear measurement strategies, while the remainder rely on conceptual or implicit assessments. Most frameworks converge on the inclusion of technical, ethical, and cognitive components. There is a trend toward multidimensionality, with frameworks increasingly incorporating affective, reflective, and collaborative elements. Distinctions arise in: level of granularity (e.g., [7] present detailed sub-competencies vs. broader categories presented in [11], intended audience (universal vs. stage-specific) and degree of empirical validation, where most frameworks are conceptual (as discussed earlier). The lack of standardized assessment imposes cross-contextual comparison and practical implementation.

Several recent studies discuss prompt engineering as a skill within AI literacy (e.g. [3] Some authors (e.g. [12].) distinguish between prompt engineering (the technical skill of formulating prompts) and prompt literacy (the broader ability to refine and critically assess AI outputs), suggesting a need for specific integration within AI literacy frameworks. Foundation for integration are prompt engineering frameworks, which can serve as basic element for integration. Recent literature reported structured frameworks such as CLEAR [13]. CLEAR consists of five principles: Concise, Logical, Explicit, Adaptive and Reflective [13]. Frameworks such as CLEAR highlight the principles needed to formulate purposeful prompts, emphasizing the skills involved in human–AI interaction.

Building on these foundations, the next section explores how prompts function within educational contexts - examining their typologies, roles, and instructional potential in teaching and learning with GenAI.

## 3 Functions and Typologies of Prompts in Educational Practice

Prompts are widely used to generate and adapt educational content, including lesson plans, problem solutions, explanations, and creative outputs (such as poetry, art, and guided tours). Automated content creation and personalization are common, especially in higher education and science, technology, engineering, and mathematics (STEM) disciplines. Prompts facilitate the design of assessments, automatic grading, and real-time feedback. Examples include generating test items, providing personalized feedback, and supporting self-assessment and reflection ([14]; [15]; [16]). Prompts support student engagement through interactive activities such as Prompt Problems ([17;[18]) role-plays, Socratic questioning, and collaborative problem solving. Prompts are also used to foster critical thinking, reasoning, and dialogue-based learning.

Table 1 summarizes relevant literature insights regarding prompt engineering templates and effectiveness.

**Table 1.** Prompt engineering templetes and effectivness

| Task Category | Prompt Template | Implementation Guidelines | Reported Effectiveness |
|---|---|---|---|
| Content generation | ”Generate a lesson plan on [topic] for [grade level].” | Use structured frameworks (PARTS, CLEAR); iterative refinement | Reported to enhance efficiency and personalize content ([14]; [19]) |
| Assessment design | ”Create 5 multiple-choice questions on [concept].” | Specify learning objectives; use output formatting | Reported to support assessment redesign and automate grading ([15]; [16]) |
| Feedback provision | ”Provide feedback on this student essay.” | Use explicit criteria; enable feedback loops | Reported to improve relevance and quality of feedback [20];[21] |
| Computational thinking | ”Write a prompt that generates code to solve [problem].” | Scaffold with visual representations; evaluate via test cases | Reported to engage students and develop programming skills [17]; [18] |
| Critical thinking/Socratic | ”Act as a Socratic tutor and guide the student to the answer.” | Assign roles; encourage stepwise reasoning | Reported to foster higher-order thinking and engagement ([20]; [16]) |
| Collaborative learning | ”Simulate a peer discussion on [topic].” | Assign personas; structure dialogue | Reported to facilitate collaboration and peer learning [22]) |

By reviewing literature, we found six distinct task categories addressed by prompt engineering in education: content generation, assessment design, feedback provision, computational thinking, critical thinking/Socratic, and collaborative learning. Each task category had unique implementation guidelines. Most reported effectiveness outcomes were unique to each task, except for ”engagement,” which was reported for both computational thinking and critical thinking/Socratic tasks (two studies). Other outcomes (such as efficiency, personalization, assessment redesign, automating grading, relevance and quality of feedback, programming skills, higher-order thinking, collaboration, and peer learning) were each reported in one study.

# 4 A Conceptual Framework for Prompt Engineering Competence

GenAI become embedded in educational contexts and the ability of educators to construct, refine, and critically assess prompts takes on new significance. Prompt engineering is not simply a technical action - it is a multifaceted competence that encompasses cognitive understanding, practical skill, and ethical awareness. To support educators in developing this ability as part of their broader AI literacy, we propose a three-dimensional conceptual framework for prompt engineering competence, consisting of: (1) cognitive, (2) technical, and (3) ethical-critical dimension.

## 4.1 Cognitive Dimension: Understanding How Prompts Shape AI Behavior

At the core of effective prompt engineering lies an understanding of how generative AI models operate. This does not require deep expertise in machine learning, but it does involve cognitive insight into the relationship between input and output, including:

- Model behavior and context sensitivity: Educators need to be aware that large language models are sensitive to phrasing, structure, and specificity. For instance, the difference between “Summarize this text” and “Summarize this text in three bullet points focusing on key arguments” is significant in shaping the response.
- Prompt influence on tone, style, and scope: Educators should understand that the design of a prompt directly affects the style and appropriateness of the generated content. Prompts like “Explain this to a 10-year-old” versus “Provide a graduate-level explanation” yield vastly different outputs.
- Mental models of the AI: Teachers often anthropomorphize or misinterpret AI responses. A cognitively competent educator develops an accurate mental model of how AI “thinks,” recognizing it as a probability-based language model, not an intelligent agent.

This cognitive dimension aligns with the AI literacy component of "knowing what AI can and cannot do," including limitations, probabilistic reasoning, and non-deterministic outputs.

## 4.2 Technical Dimension: Formulating, Iterating, and Reusing Prompts

The second dimension involves the practical ability to write, test, and improve prompts. This is the most visible aspect of prompt engineering and involves:

- Prompt formulation strategies: Including role-based prompts (“You are a science teacher...”), task-based prompts (“Generate 5 quiz questions about…”), constraints (“Limit your response to 150 words”), and chaining (breaking tasks into subtasks).
- Prompt iteration: Educators must be able to assess the quality of AI outputs and refine their prompts accordingly. This includes experimenting with order, specificity, examples, and scope. Iteration is a skill often acquired through practice and reflection.
- Reusable templates and modular design: Prompt engineering competence includes the creation and adaptation of reusable templates, e.g., prompts for lesson planning, rubrics for feedback generation, or reflection scaffolds for students.
- Multilingual and subject-specific adaptation: Since many educators work in non-English environments, the ability to adapt prompts to different languages and subject-specific terminology is essential.
- Tools and interfaces: Technical competence also includes fluency in the tools used (e.g., ChatGPT’s custom instructions, prompt libraries, prompt editors) and awareness of their limitations and updates.

This dimension mirrors the “skills” layer of AI literacy - particularly the ability to use AI tools productively and effectively in varied educational contexts.

## 4.3 Ethical-Critical Dimension: Responsible and Reflective Prompt Use

The third, often underemphasized dimension of prompt engineering competence concerns ethical awareness and critical reflection. Educators do not only shape the AI’s output - they also have responsibility for its pedagogical impact.

- Bias and fairness: Prompts can generate biased content, reinforce stereotypes, or marginalize certain perspectives. Competent educators should be able to detect and address such issues and adjust prompts accordingly.
- Academic integrity: Prompt engineering raises questions of originality and authorship. For instance, if an educator generates feedback or assignments via AI, how should this be disclosed? Where is the line between support and automation?
- Transparency with learners: Prompt use should be transparent to students. Ethical competence involves the ability to explain AI involvement in learning processes and model responsible use.
- Over-reliance and de-skilling: Educators must be able to critically assess when the use of AI is enhancing pedagogy and when it may lead to reduced pedagogical engagement.

- Equity and access: Prompt engineering competence includes awareness of accessibility and inclusivity - designing prompts that consider diverse learners, cultural contexts, and digital divides.

This dimension draws from critical digital pedagogy and responsible AI frameworks. It emphasizes reflection-in-action and reflection-on-action - helping educators become thoughtful users of powerful tools.

### 4.4 Integrating the Three Dimensions into Learner and Educator Development

The three dimensions outlined above are interdependent. For example, a technically well-defined prompt may still produce ethically problematic content if cognitive understanding of model behavior is lacking. Similarly, ethical reflection is difficult without practical experience or conceptual insight. For integration into educator training, we propose a matrix of competencies aligned with these dimensions. Table 2 would cross-reference pedagogical tasks (e.g., content creation, feedback generation, critical thinking support) with competency areas (cognitive, technical, ethical). This provides a foundation for curriculum design, self-assessment tools, and professional development programs.

We argue that prompt engineering should not be treated as an isolated “trick” or quick fix. Rather, it is a layered competence that must be systematically developed through a blend of conceptual understanding, practical engagement, and ethical deliberation. Its integration into educator education is essential to ensure that educators remain empowered, reflective agents in AI-mediated learning environments.

**Table 2.** Prompt engineering competence matrix

| Educational task | Cognitive competence | Technical competence | Ethical-Critical Competence |
|---|---|---|---|
| Lesson/Content generation | Understand how prompt structure affects output depth, tone, and scope | Formulate structured prompts for curriculum-aligned materials (e.g., quizzes, summaries, slides) | Ensure content accuracy, factual consistency, and absence of bias or misrepresentation |
| Feedback to Students | Interpret how prompts influence formative vs. summative tone of feedback | Design adaptive prompts for rubric-based or formative feedback | Maintain transparency in AI-generated feedback; avoid depersonalization |
| Student Support | Anticipate different student needs and learning levels in prompt design | Create prompts for explainers, examples, hints, and adaptive questioning | Prevent reinforcing stereotypes or misalignment with learners' backgrounds |

| | | | |
|---|---|---|---|
| Critical Thinking | Recognize how prompting can scaffold analysis, evaluation, or reflection | Use prompts to stimulate Socratic questioning, debates, or multiperspective reasoning | Avoid oversimplification; ensure inclusion of diverse perspectives |
| Assessment Design | Predict how prompt framing affects the cognitive demands of tasks | Generate question sets, rubrics, or case studies using varied prompt structures | Ensure fairness, avoid answer leakage, and protect academic integrity |
| Professional Communication | Understand model behavior in context of formal/informal register, tone, and audience | Use role-based or persona prompts (e.g., "Write an email as a department head explaining...") | Communicate transparently about AI use; avoid manipulation or AI overreach |
| Tool Mediation (AI in classroom) | Understand how AI mediates knowledge creation and teacher-student interaction | Teach students how to co-create prompts; integrate guided prompting activities into lessons | Model responsible use; discuss AI's limitations and potential social impacts |

This table can serve as the foundation for a training curriculum, self-reflection checklist, or teaching portfolio rubric. Each row can be expanded into learning outcomes, micro-credentials, or rubric-based assessments for educator competence in prompt engineering. Also, different versions adapted for primary/secondary vs. higher education can also be developed.

## 5 Conclusion

GenAI continues to change educational environments and there is the need for educators and learners to develop new competencies. Among these, prompt engineering emerges as a key skill - yet one that is often underestimated, informal, and insufficiently integrated into professional development frameworks. This paper has argued that prompt engineering is not merely a technical tool, but a core component of AI literacy for educators and learners, requiring cognitive insight, practical skill, and ethical reflection. We proposed a three-dimensional conceptual framework of prompt engineering competence - cognitive, technical, and ethical-critical - and illustrated its relevance through common educational tasks. This framework is intended to serve as a foundation for training programs, curriculum design, and self-assessment practices. In doing so, the paper tries to shift the discourse around prompt engineering from anecdotal techniques to a structured pedagogical literacy, grounded in educational theory and aligned with emerging AI literacy standards.

The findings and framework presented in this paper have several implications:

(i) Teacher education and continuous professional development programs should incorporate structured modules on AI literacy, with explicit focus on prompt engineering.
(ii) Educational institutions and policymakers should recognize prompt engineering as a transferable digital-educational skill and support the creation of resources, tools, and guidelines for its responsible application.
(iii) Curriculum developers can use the proposed matrix (Table 3) as a basis to design micro-credentials, workshops, and integrated learning tasks involving generative AI.

This paper contributes to the growing field of AI in education by conceptualizing prompt engineering as a literacy-based competence rather than a purely technical task, aligning prompt engineering with broader theoretical frameworks of AI literacy, proposing a structured model that can inform both pedagogical theory and teacher training design, and providing a typology of educational use cases mapped to specific competency dimensions.

By doing so, the paper addresses a gap in the current literature, which has so far emphasized tool use but has often overlooked the development of underlying educator competencies. While the framework presented is grounded in theory and supported by a synthesis of current literature, several limitations must be acknowledged: the paper does not include empirical validation of the framework through classroom studies, educator surveys, or intervention trials; the proposed competency matrix, while illustrative, may require adaptation for specific contexts, such as early childhood education, vocational training, or multilingual environments; AI tools and prompt strategies are rapidly evolving, which may limit the framework's longevity unless updated regularly. To build upon the ideas presented here, future research should:

(i) Conduct empirical studies testing how different types of educators engage with prompt engineering across disciplines and educational levels;
(ii) Explore learner perspectives on prompts generated or used by educators, particularly regarding transparency, trust, and engagement;
(iii) Develop and validate rubrics and training modules based on the proposed framework;
(iv) Investigate cultural and linguistic dimensions of prompt engineering competence in non-English speaking contexts;
(v) Examine the long-term pedagogical impact of integrating prompt engineering into teaching routines on student learning outcomes and educator agency.

In conclusion, the integration of generative AI into education presents both opportunity and responsibility. Prompt engineering stands at the intersection of pedagogy and technology, requiring not only technical fluency but reflective, ethical, and learner-centered thinking. By framing it as a literacy for the age of AI, we empower educators not only to use these tools - but to shape their use in ways that uphold the values and goals of education itself.

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## Declaration on Generative AI

During the preparation of this work, the authors used Claude and Perplexity in order to: edit references, grammar, and spelling check, improve readability, and streamline language. After using tools/services, reviewed and edited the content as needed, and took full responsibility for the publication's content.

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