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Prompts to Practice: A Pedagogical Framework for Human-Centered AI Engagement

RESEARCH ARTICLES

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INTERNATIONAL COUNCIL FOR OPEN AND DISTANCE EDUCATION

ABSTRACT

As generative AI evolves from an assistive tool to an increasingly autonomous system, higher education faces new challenges for teaching and learning. Emerging research describes the rise of the "ghost student," who completes coursework without active participation, and the "cognitive debt" that accrues when productive struggle is outsourced to automated systems. These developments expose the limits of reactive, compliance-focused approaches. In response, this conceptual paper argues that purposeful, human-centered AI engagement offers a better path forward. Drawing on constructionist learning theory, we introduce the Instructional Model for Human-Centered Generative AI Engagement, a pedagogical framework designed to help faculty guide students in engaging with generative AI as a thinking partner rather than a shortcut. The model consists of five recursive phases: critical and ethical awareness, prompt literacy, AI-supported learning, reflection and revision, and independent application. Central to its implementation is the Prompt Literacy Cycle, nested within Phase Two, which guides students through iterative prompting, critical interpretation of LLM-generated outputs, and reflective revision. Together, these elements support a shift towards process-oriented assessment while fostering ethical awareness, metacognition, and intentional engagement with LLM-mediated knowledge construction.

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KEYWORDS:
generative AI; large language models; constructionism; prompt literacy; prompt engineering; critical pedagogy; higher education; human-centered learning; academic integrity; instructional framework

TO CITE THIS ARTICLE:
Miles, A. J., Haber-Curran, P., & Arar, K. (2026). Prompts to Practice: A Pedagogical Framework for Human-Centered AI Engagement. *Open Praxis*, *18*(3), pp. 481–494. DOI: https://doi.org/10.55982/openpraxis.18.3.1191

INTRODUCTION

The rapid integration of generative artificial intelligence (AI) into academic and professional life demands a deliberate pedagogical response from higher education, one that goes beyond policy and addresses how students learn to use these tools with intention and judgment. This manuscript focuses specifically on text-based large language models (LLMs) such as ChatGPT, Copilot, Gemini, Perplexity, and Claude. While generative AI encompasses a broader range of systems that produce images, audio, and video, LLMs serve as the primary lens here because of their direct role in academic writing, reasoning, and knowledge construction. Rather than treating these tools as threats to be prohibited, institutions have an opportunity to teach students to use them effectively, responsibly, and ethically. We describe this approach as human-centered AI engagement, which is defined in the following section.

Emerging research deepens the urgency of this challenge. Bozkurt et al. (2026) describe the emergence of the "ghost student," a digital surrogate capable of navigating learning management systems, completing assignments, and submitting coursework without the learner's active participation. This development reframes concerns about academic integrity not merely as a matter of individual misconduct, but as a structural vulnerability within current assessment models, one that calls for a pedagogical response rather than a disciplinary one. When generative AI substitutes for student thinking rather than supporting it, learners risk accumulating what Bozkurt et al. (2026) describe as "cognitive debt," a condition in which the productive struggle essential to deep learning is quietly outsourced to automated systems. These developments expose the limits of reactive, compliance-focused approaches and signal the need for intentional instructional frameworks.

Recent scholarship reinforces this point. AI in education is not a transient phenomenon but a systemic transformation reshaping teaching, learning and leadership practices across educational context (Arar, Özen, et al., 2025; Mustafa et al., 2024). DeMatthews and colleagues argue that AI is no longer simply a technological innovation but a leadership imperative requiring ethical responsibility, equity-centered decision-making, and strategic guidance across educational systems (2026). While that work focuses on K-12 leadership, it strengthens the argument that higher education must also move beyond reactive responses toward human-centered frameworks for AI integration.

Within higher education, faculty attitudes toward AI vary widely. Some instructors embrace these tools for their potential to support learning and increase access, while others remain skeptical of their academic and ethical implications (Chan & Tsi, 2023; Huang et al., 2025; Joyce, 2023; Tu, 2024). This range of perspectives reflects an ongoing, unresolved debate over whether AI represents a benefit or a risk for education (Mogavi et al., 2024; Rawal, 2025; Theresiawati et al., 2025). What is increasingly clear, however, is that faculty uncertainty alone cannot substitute for purposeful pedagogical guidance.

Much of the existing literature on AI in higher education addresses policy compliance, academic integrity enforcement, or general AI literacy. These approaches share a common limitation: they position students as risks to be managed rather than learners to be developed. Less attention has been given to instructional frameworks that treat LLM engagement as a teachable, scaffolded process, one that builds ethical reasoning, rhetorical awareness, and intellectual ownership over time. Existing frameworks do address AI in education, but largely at the level of policy or competency rather than classroom enactment (e.g., Chan, 2023; Chiu & Rospigliosi, 2026; UNESCO, 2024). Chan (2023), for example, offers a comprehensive institutional framework for governing AI use in university teaching and learning, while UNESCO (2024) and the broader landscape of official frameworks synthesized by Chiu and Rospigliosi (2026) define the competencies—the "what"—that learners and educators are expected to develop. These frameworks provide essential reference points, yet they stop short of specifying how individual instructors might cultivate such competencies in day-to-day practice. The present model addresses that gap by offering a classroom-level "how": a phase-sequenced instructional process, centered on prompt literacy, that an instructor can enact directly with students. While much of the existing scholarship has focused on the leadership, policy, and ethical implications of AI integration across educational systems (Arar, Tlili, et al., 2025), less attention has been given to how these principles are enacted within classroom pedagogy. Leadership scholarship establishes the system-level mandate for ethical, equity-centered AI

integration (Arar, Özen, et al., 2025; DeMatthews et al., 2026); the framework offered here operationalizes that mandate at the instructional level, translating the values leaders articulate into concrete classroom practice. In this sense, leadership defines why human-centered AI integration matters, while the present model provides the means by which faculty can enact it. In response, this article introduces the Instructional Model for Human-Centered Generative AI Engagement, a constructionist pedagogical framework designed to guide students in engaging with generative AI as a thinking partner rather than a shortcut. A central contribution of the framework is its distinction between prompt engineering, which focuses on technical optimization of AI inputs, and prompt literacy, which emphasizes rhetorical awareness, ethical responsibility, and critical interpretation. Drawing on classroom practice and existing research, the model offers instructors practical strategies for scaffolding AI-integrated learning while keeping human thinking at the center. Central to this is the role instructors play in modeling transparency and intentional practice, reflecting the framework's commitment to deliberate and ethical relationship with LLMs, one in which AI serves as a collaborator in learning rather than a replacement.

Higher education is a particularly important site for this work. Unlike K-12 contexts where curriculum is more tightly structured, faculty in higher education have significant autonomy over pedagogical design, making instructor-level frameworks especially actionable. College students are also at a critical stage of developing independent intellectual identity, and how they learn to engage with LLMs now will shape their professional and academic practices long after graduation.

HUMAN-CENTERED AI ENGAGEMENT

Central to this framework is the concept of human-centered AI engagement, which we define as an intentional, reflective approach in which students work with generative AI as a thinking partner rather than a shortcut. In this view, the goal of instruction is not to maximize what AI can produce, but to ensure that students exercise judgment, ethical responsibility, and ownership over their learning, so that human reasoning remains at the center of knowledge construction. Human-centered AI engagement therefore treats generative AI as a collaborator in thinking, one whose outputs are interrogated, revised, and integrated rather than passively accepted.

This orientation distinguishes the present approach from two common responses to generative AI in higher education. The first treats AI primarily as a threat to be prohibited or policed, an essentially reactive posture that positions students as risks to be managed. The second embraces AI for its efficiency, prioritizing speed and convenience in ways that can quietly displace the productive struggle essential to deep learning. Human-centered AI engagement instead foregrounds intentionality, human judgment, ethical awareness, and learner agency. It asks not whether students use AI, but how they engage with it: whether they do so critically, transparently, and in service of their own intellectual growth. The remainder of this article develops this orientation, first through its theoretical grounding in constructionism and then through an instructional model that translates these principles into classroom practice.

We come to this topic as educators and scholars committed to exploring the pedagogical and ethical implications of AI in higher education. With backgrounds in instructional design, college teaching, student development, and educational and community leadership, we bring practical experience and critical inquiry to this work. We approach AI integration not as a question of technology alone, but as an opportunity to reimagine teaching and learning through a constructionist lens.

A CONSTRUCTIONIST LENS FOR INCORPORATING AI

A constructionist pedagogical approach, grounded in Papert's (1980) work, offers a powerful lens for guiding students in ethical, responsible, and effective practices with AI. Constructionism emphasizes that learners construct knowledge most meaningfully when they create tangible, personally meaningful artifacts and engage in reflective dialogue (Bernauer & Fuller, 2017; Papert & Harel, 1991). When applied to LLMs, this means inviting students to engage as

co-creators, to draft, explore ideas, and/or build digital artifacts that reflect their thinking, authorship, and values.

Rather than treating AI as a threat to academic integrity, constructionist pedagogy frames generative AI as "objects to think with," cognitive and creative partners that spark inquiry, deepen engagement, and promote critical thinking (Adel et al., 2024; Chen et al., 2025; Vasconcelos & dos Santos, 2023). Unlike static digital tools that simply deliver information, LLMs respond dynamically to student input, allowing learners to iteratively test ideas, revise prompts, and explore alternative perspectives in real time. This responsiveness makes LLMs particularly compatible with constructionist learning environments, where knowledge emerges through experimentation, dialogue, and reflection.

This approach reflects a growing recognition that AI can support deeper learning when used within intentional pedagogical frameworks (Arar, Tlili, et al., 2025; Huang et al., 2025; Tlili et al., 2025). This pedagogical emphasis also complements recent AI leadership scholarship, which argues that ethical and effective AI integration depends not only on technical adoption but on leadership practices that foreground equity, human judgment, and educational purpose (DeMatthews et al., 2026). In the context of higher education, such leadership must extend into the design of teaching and learning processes themselves.

A constructionist approach to teaching LLMs emphasizes learning through active creation and iterative reflection, positioning students as agents in shaping their own work and thinking. When generative AI substitutes for student thinking rather than supporting it, learners risk accumulating the cognitive debt described above. In such cases, assignments may appear complete while the learner's conceptual understanding remains unchanged. Rather than using LLMs to complete tasks, students are invited to engage in purposeful experimentation, examining how their choices influence meaning, voice, and ethical outcomes.

For example, students may generate a piece of writing using an LLM and then annotate or critique the LLM-generated contributions. Students may examine questions such as: What assumptions does the LLM make? What biases are present? How might the tool affect authorship, originality, or accuracy? This reflection process supports deeper learning, metacognition, critical judgment, and moral reasoning, core components of responsible technology use (Lee et al., 2024; Wang et al., 2025). By treating LLM outputs as a first draft rather than a finished product, students remain in control of their intellectual process, positioning themselves as active creators rather than passive consumers (Xie, 2023).

Constructionist assignments are rooted in student agency, creativity, and relevance (Kafai & Burke, 2015; Papert & Harel, 1991; Xie, 2023). LLM-supported assignments might include designing prompt strategies for writing goals, using an LLM as a writing coach, or building LLM-assisted personal statements. Students can develop and assess classroom AI use policies or collaboratively develop guidelines for permitted AI in group work. What distinguishes these assignments is not the use of technology alone, but the opportunity for students to engage in the process of building, iterating, and sharing while receiving feedback from peers and the instructor. These learning activities serve as launching pads for discussions about authorship, bias, ownership, and the broader societal implications of AI. Students can engage in a learning cycle that encourages ethical awareness and responsibility.

In constructionist learning environments, faculty shift from content experts to facilitators and co-learners, modeling curiosity, humility, and ethical discernment (Resnick, 2017; Vasconcelos & dos Santos, 2023). This pedagogical stance is especially important in the context of AI, where norms and best practices are still emerging. By engaging with LLMs alongside students (e.g., sharing examples of how they are experimenting with these tools), faculty foster a culture of transparent, dialogic learning. Faculty scaffold students' understanding through timely feedback and co-constructed norms. A constructionist approach to teaching LLMs doesn't simply equip students with technical skills; it invites them into the learning process and helps them develop critical dispositions they will need to navigate increasingly complex digital environments confidently, ethically, and thoughtfully. This approach also aligns with the broader potential of AI in higher education to foster integrity, innovation, and resilience within academic ecosystems (Arar, Özen, et al., 2025; Mustafa et al., 2024; Theresiawati et al., 2025). The constructionist principles highlight both the opportunities and the pedagogical

risks associated with generative AI in higher education, raising important questions about how instructors can intentionally design learning environments that preserve student thinking and agency.

CHALLENGES AND OPPORTUNITIES OF GENERATIVE AI IN THE CLASSROOM

The relevance of generative AI in higher education could not be more pressing. This section highlights how rapid industry development of educational AI tools is reshaping the pedagogical landscape and increasing the need for intentional instructional frameworks. As AI continues to evolve at a rapid pace, industries outside of education see its potential to transform learning and, in some cases, to infiltrate it in ways that bypass traditional pedagogical values. Business and tech sectors are racing to develop the next big innovation in AI for education. Major companies such as OpenAI, Google, and Anthropic are developing education-specific generative AI and forging partnerships to embed AI tools directly into classrooms and learning management systems. Generative AI tools are no longer general-purpose assistants; they are increasingly being tailored for student use, teacher support, and even automated assessment (OpenAI, 2024). As these technologies become embedded in educational infrastructures, the need for pedagogical frameworks that guide students in engaging with AI critically and intentionally becomes increasingly urgent. While these developments bring exciting possibilities, they also pose significant risks. If educators are not actively teaching students to engage with AI critically, ethically, and reflectively, we risk allowing these technologies to reshape education in ways that prioritize convenience over learning and efficiency over equity, a concern echoed in leadership scholarship calling for ethically grounded AI policy and human-centered implementation (Arar et al., 2024; Arar, Tlili, et al., 2025). Educators and academic leaders have a responsibility to model thoughtful AI use and ensure these tools enhance—rather than erode—the values and integrity of higher education. By taking a proactive, pedagogically grounded approach, educators can help ensure AI becomes a positive force in academic spaces.

INSTRUCTIONAL MODEL FOR HUMAN-CENTERED GENERATIVE AI ENGAGEMENT

The instructional model presented in this study draws on these constructionist principles to structure student engagement with LLMs. To support students in becoming intentional, ethical, and effective users of LLMs in higher education, we introduce the Instructional Model for Human-Centered Generative AI Engagement (Figure 1). As a conceptual contribution, the model was developed by synthesizing established learning theory with the authors' instructional experience and ongoing research on generative AI in higher education, rather than derived from a single empirical study. The model is organized around five recursive phases: critical and ethical awareness, prompt literacy, AI-supported learning, reflection and revision, and independent application. Each phase supports the development of student learning capacities that guide thoughtful and responsible use of LLMs. This instructional framework is designed to help faculty scaffold LLM-related learning by integrating hands-on experimentation, ethical reflection, and purposeful interaction with LLMs. This framework responds to broader calls within educational leadership scholarship for ethically grounded, human-centered, and evidence-based approaches to AI integration across educational systems (Arar, Özen, et al., 2025).

Drawing from critical pedagogy (Freire, 1970), constructionist learning theory (Papert & Harel, 1991), and an ethics of care that foregrounds relational and human-centered teaching (Noddings, 2003), this framework offers a human-centered and ethically grounded approach to learning with LLMs. At its core, the framework assumes that generative AI cannot replace the relational elements that sustain meaningful learning. Feedback, encouragement, empathy, and cultural responsiveness remain central to the human-centered approach that guides the instructional model. Prompt literacy (Chan, 2023; Walter, 2024) serves as the central pedagogical mechanism within the framework. Rather than teaching students simply how to use LLMs, the framework emphasizes learning through creation, iteration, and dialogue, supporting students in developing the critical consciousness, AI literacy, and ethical grounding needed to engage responsibly with AI across disciplines. This pedagogical framework also

resonates with DeMatthews et al.'s (2026) argument that AI use in educational settings should be guided by leadership domains that emphasize ethical integration, instructional innovation, equity, and stakeholder engagement. Whereas their framework addresses AI leadership at the school and systems level, the present model extends that conversation into the higher education classroom by focusing on how instructors can cultivate reflective, ethical, and human-centered engagement with LLMs in daily teaching practice.

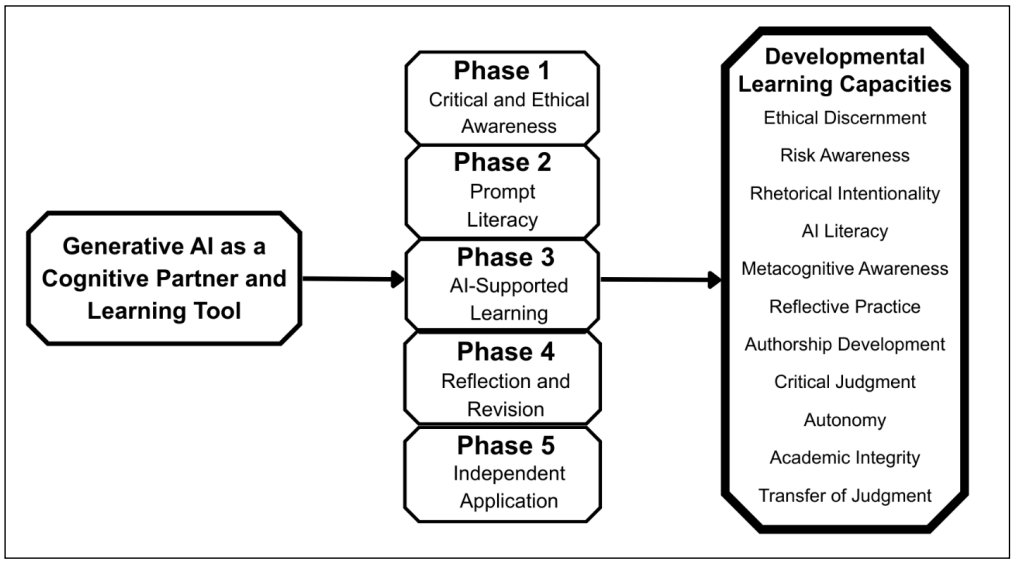

Figure 1 Instructional Model for Human-Centered Generative AI Engagement.

While much public discourse around AI emphasizes productivity, automation, or compliance, the Instructional Model for Human-Centered Generative AI Engagement repositions generative AI as a thinking partner that can extend and deepen learning when approached critically and reflectively. The five phases provide a process for instructors to introduce LLMs and guide students to become conscious, ethical, and effective users through a constructionist approach. Through this process, students develop learning capacities that deepen understanding, engagement, and agency.

PURPOSE AND APPLICATION

The Instructional Model for Human-Centered Generative AI Engagement provides instructors with a pedagogical structure for scaffolding students' engagement with LLMs over time. Rather than viewing AI as a one-time lesson or isolated tool, the framework encourages a cyclical, developmental approach that supports students in becoming reflective and ethically aware users of LLMs. In a constructionist learning environment, the learning process is woven into meaningful creation and metacognitive reflection, enabling students to question, revise, and intentionally expand on LLM outputs.

Scholars increasingly argue that traditional output-based assessments are becoming unreliable indicators of learning in AI-mediated environments (Awadallah Alkouk & Khlaif, 2024; Kofinas et al., 2025). As generative AI enables sophisticated task completion without genuine engagement, institutions are called to move toward process-oriented and dialogic forms of assessment that foreground human presence, reflection, and explanation (Bozkurt, 2024; Bozkurt et al., 2026). Each phase of the framework described below is designed with precisely this in mind, prioritizing iterative prompting, reflective revision, and metacognitive engagement over measurable output alone.

To illustrate how prompt literacy can be assessed as a process rather than a product, Table 1 offers a sample rubric. Rather than grading the AI-generated output itself, the rubric evaluates the student's engagement with the tool—how deliberately they refine prompts, how critically they interpret responses, and how thoughtfully they revise. Instructors can adapt these criteria to discipline-specific assignments while keeping human reasoning and judgment at the center of evaluation.

CRITERION	DEVELOPING	PROFICIENT	EXEMPLARY
Iterative Refinement	Submits a single prompt with little adjustment; accepts the first output.	Revise prompts across two or three attempts in response to output quality.	Systematically refines prompts, articulating why each change improves the response.
Critical Interpretation of Output	Accepts AI output at face value; little evaluation of accuracy or bias.	Identifies some inaccuracies, gaps, or biases in the output.	Rigorously evaluates output for accuracy, bias, and relevance, and explains the reasoning.
Reflective Revision	Uses AI output with minimal personal revision or reflection.	Revise the output and notes on how it shaped the final work.	Integrates and transforms output through substantive revision, reflecting critically on how AI influenced their thinking.

Table 1 Sample Rubric for Assessing Prompt Literacy.

THE FIVE PHASES OF THE FRAMEWORK

The framework consists of five phases that can be adapted across assignments, units, or entire courses (Table 2). The phases support both cognitive and ethical development while offering instructors clear opportunities to scaffold and model LLM-integrated learning. Each phase builds on the previous, yet the process remains recursive. Instructors can revisit earlier phases, using modeling, transparency, and classroom culture to reinforce the framework's values. Together, these phases guide students in developing the mindset needed to work with LLMs effectively, responsibly, and reflectively.

PHASE		PEDAGOGICAL FOCUS	DEVELOPMENTAL OUTCOMES
1.	Critical and Ethical Awareness	Understanding Risks and Responsibilities	Ethical Discernment and Risk Awareness
2.	Prompt Literacy	Engage with the Prompt Literacy Cycle	Rhetorical Intentionality and AI Literacy
3.	AI-Supported Learning	Use LLMs for Brainstorming and Drafting	Metacognitive Awareness and Reflective Practice
4.	Reflection and Revision	Critically Evaluate and Refine Work	Authorship Development and Critical Judgment
5.	Independent Application	Apply AI Responsibly in Academic Work	Autonomy, Academic Integrity, and Transfer of Judgment

Table 2 Instructional Model for Human-Centered Generative AI Engagement: Phases, Pedagogical Focus, and Developmental Outcomes.

Phase 1: Critical & Ethical Awareness

This foundational phase introduces students to the ethical, social, and political dimensions of generative AI. Instructors begin by discussing what LLM systems are, how they are trained, and the risks associated with their use, including bias, misinformation, surveillance, and academic dishonesty. Classroom discussions, media analysis, or short reflective readings help students develop ethical discernment and awareness of potential risks associated with LLMs. (Chan, 2023). This sets the tone for ethical inquiry, encouraging curiosity, caution, and responsibility. Instructors model transparency by acknowledging their own learning process with LLMs, sharing how they navigate ethical dilemmas, and co-creating norms of respect, autonomy, and fairness (Adel et al., 2024; Arar, Özen, et al., 2025).

Phase 2: Prompt Literacy

Prompt literacy is a central pedagogical focus in teaching students to engage with generative LLMs in reflective and responsible ways. In this phase, students move beyond prompt engineering, a practice rooted in technical optimization, and instead, embrace prompt literacy as a recursive, rhetorical, and ethical process that develops rhetorical intentionality in students' interactions with LLMs. While prompt engineering is a technical skill set, focused on fine-tuning inputs for performance (Walter, 2024), prompt literacy is rooted in student-centered pedagogy. It emphasizes clarity of purpose, ethical responsibility, and critical reflection in designing prompts and interpreting outputs (Chan, 2023; Gattupalli et al., 2023). The distinction reflects a growing recognition that the ability to guide AI toward meaningful and ethical outputs represents a foundational literacy for contemporary learners. (Bozkurt, 2024). The Prompt Literacy Cycle, a practical framework for developing prompt literacy, is presented in the next section.

Phase 3: AI-Supported Learning

In this phase, students use LLMs for academic tasks such as brainstorming, outlining, summarizing, or drafting. The emphasis is on extending, not replacing student thinking. This distinction carries significant pedagogical weight: when generative AI substitutes for student cognition rather than supporting it, losingand having. The consequence is not always visible on the surface; assignments may be completed successfully, while the learner's conceptual understanding remains fundamentally unchanged. Instructors can address this risk directly by asking students to generate both human-written and LLM-assisted drafts, then compare and revise them. Through this process, students develop metacognitive awareness as they reflect on how LLMs shape their thinking, writing decisions, and revision strategies. Students examine how LLM-generated responses reflect or fail to reflect their goals, how tone or clarity shifts with prompt quality, or how human judgment is required to craft strong arguments and authentic authorship. When instructors transparently model their use of LLMs, they normalize intentional, thoughtful collaboration with these tools (Gattupalli et al., 2023; Walter, 2024).

Phase 4: Reflection & Revision

This phase invites students to step back and focus on process. Students consider what they learned through prompting, writing, and revising with LLMs. They uncover patterns in the feedback they received or the decisions they made. Instructors can encourage students to annotate drafts, journal thought processes, or engage in peer reviews that focus on how ideas were developed and refined. Reflection becomes an opportunity to examine originality and authorship while strengthening students' critical judgment about how LLMs contributes to their work. By revisiting earlier choices and alternative paths, students develop metacognitive awareness and deeper understanding of writing and thinking processes (Anjarani et al., 2024; Walter, 2024). Instructors can reinforce this by asking students to reflect on the what, why, and how of their LLM use (Lee et al., 2024).

Phase 5: Independent Ethical Application

The final phase challenges students to apply their learning beyond the boundaries of the course. Assignments can include personal AI use policies, critical evaluations of AI tools, or field-specific explorations of responsible AI use. This phase supports transfer of judgment by encouraging students to establish boundaries, clarify values, and make informed decisions about AI use in real-world contexts. As students navigate these decisions independently, they strengthen their autonomy and academic integrity when working with AI. Faculty frame this as ongoing ethical inquiry, equipping students to ask tough questions, adapt to new technologies, and advocate for inclusive, equitable AI practices (Arar, Özen, et al., 2025; Chan & Tsi, 2023).

Together, these five phases form a developmental learning progression. Students move from initial awareness of AI's ethical and epistemic implications toward independent and responsible use in academic and professional contexts. The framework begins by cultivating ethical discernment and critical awareness, then builds students' capacity for rhetorical intentionality through prompt literacy. As students engage in AI-supported learning and reflective revision, they develop metacognitive awareness, a stronger sense of authorship, and critical judgment. Ultimately, the model supports the transfer of that judgment beyond the classroom, enabling students to navigate emerging AI technologies with autonomy, integrity, and responsibility.

PROMPT LITERACY CYCLE

The Prompt Literacy Cycle (Figure 2) is the instructional tool nested within Phase Two of the Instructional Model for Human-Centered Generative AI Engagement, designed to give students a concrete, repeatable structure for developing prompt literacy. While the five-phase model guides the overall arc of LLM-integrated learning, the Prompt Literacy Cycle operates at the level of daily practice, helping students engage with LLMs through recursive experimentation, rhetorical awareness, and ethical reflection. Prompting involves technical decision-making and critical interpretation, which can be difficult to develop (Gattupalli et al., 2023; Walter, 2024). To support instructors in teaching prompt-related skills that go beyond output optimization (Arar et al., 2024; Gattupalli et al., 2023; Lee et al., 2024; Walter, 2024), the cycle offers a tangible structure that faculty can use to demystify LLMs and embed critical prompt literacy into their

teaching. Instructors can introduce it through demonstrations, scaffolded assignments, or workshops, encouraging students to internalize the mechanics of prompting and the ethical and epistemological dimensions of engaging with LLMs (Chan, 2023; Gattupalli et al., 2023).

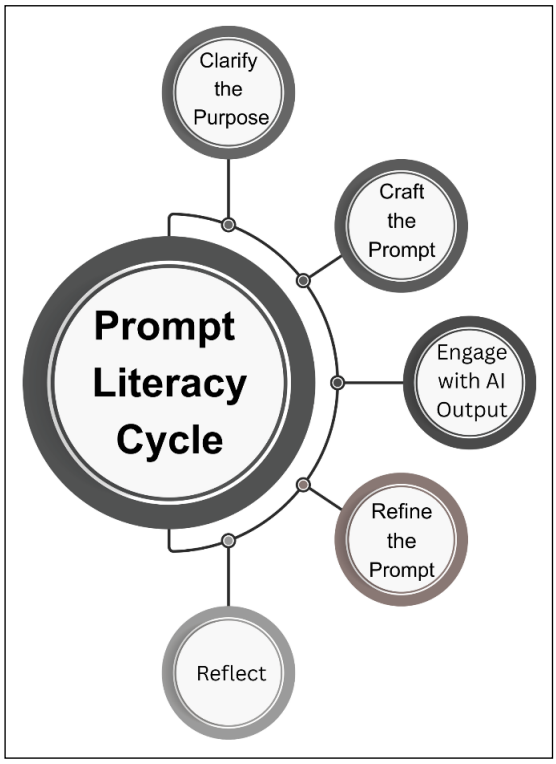

Figure 2 Prompt Literacy Cycle.

The Cycle guides students through a structured process that encourages experimentation, reflection, and interactive improvement in their interactions with LLMs.

1. Clarify Purpose – Students begin by defining their intention. What are they trying to explore, produce, or understand? This ensures prompts align with meaningful learning objectives.
2. Craft the Prompt – Students design their initial prompt, considering tone, scope, audience, and specificity. Instructors model how minor language changes dramatically alter generative LLM output.
3. Engage with Output – Students review the LLM-generated text critically. They annotate or evaluate its strengths and weaknesses in terms of relevance, bias, completeness, or tone. This stage builds skills in judgment and discernment.
4. Refine the Prompt – Students revise their prompt and re-engage with the LLM based on their evaluation. They explore how changes to the input affect the quality and focus of the output, promoting experimentation and iteration.
5. Reflect – Students reflect on the entire process. What did they learn about how prompts function? What assumptions or perspectives shaped the LLM's response? How will they apply this awareness to future interactions?

Integrating the Prompt Literacy Cycle can cultivate deeper student agency, intentionality, and confidence in working with LLMs.

TEACHING APPLICATIONS FOR GENERATIVE AI–SUPPORTED LEARNING

Building on the Instructional Model for Human-Centered Generative AI Engagement, this section outlines teaching strategies and assignments for hands-on, exploratory engagement with LLMs. The learning activities are designed to build technical fluency with LLMs and to support ethical awareness, critical reflection, and learner agency. Rooted in the principles of constructionism, these strategies position students as co-constructors of knowledge, exploring

LLMs through creation, iteration, and inquiry. Through this application, students develop practical skills and a deeper conceptual understanding. Among these activities, the Compare Prompt Literacy vs. Prompt Engineering exercise in Phase Two is particularly significant. By asking students to map the differences between technical optimization and rhetorical, ethical engagement, the activity makes the paper's central conceptual distinction directly teachable and provides students with a concrete framework for understanding why prompt literacy matters beyond simply producing better AI outputs. Table 3 illustrates this and other classroom activities aligned with each phase of the instructional model.

Table 3 Sample Teaching Applications.

PHASE AND INSTRUCTIONAL GOAL	TEACHING APPLICATIONS
Phase 1: Critical and Ethical Awareness Goal: Introduce LLM basics, limitations, and ethics.	• AI Bias Exploration: Students review LLM responses on a social issue to identify potential biases, stereotypes, or omissions. • Ethical Case Studies: Use real or hypothetical misuse cases (e.g., plagiarism, bias, misinformation) for group discussions. • LLM 101 Mini-Lecture & Guided Discussion: Present how LLMs are trained, and outputs are generated; students reflect on surprises or concerns.
Phase 2: Prompt Literacy Goal: Teach students to engage with LLMs using the Prompt Literacy Cycle.	• Prompt Remix Workshop: Students refine a vague prompt, generate LLM output, then refine it through multiple iterations. They compare and discuss differences in output and quality. • Prompt + Output Annotation: Students craft prompts, generate LLM output, and annotate for tone, clarity, completeness, and bias. • Prompt Literacy Cycle Journaling: After each stage, students journal about what they did, what happened, and what they learned. • Compare Prompt Literacy vs. Prompt Engineering: Facilitate a class debate or Venn diagram activity on how prompt literacy differs from technical prompt engineering.
Phase 3: AI-Supported Learning Goal: Use LLMs to enhance, not replace, student work.	• AI + Human Draft Comparison: Students write a paragraph, then generate one with an LLM, annotate differences in tone, depth, and authorship, and revise for a final submission. • Collaborative Idea Generator: In groups, students use LLMs to brainstorm topics or thesis statements, then evaluate which ideas to keep and why. • Socratic Seminar with AI Support: Before discussion, students use LLMs to gather perspectives and critique what is useful or lacking.
Phase 4: Reflection and Revision Goal: Promote metacognition and thoughtful LLM-influenced revision.	• Revision Log: Students log LLM-assisted drafts, noting changes, acceptances, rejections, and reasons why. • Authorship Workshop: Students assess whether LLM output matches their own authorship and explain their choices. • AI-Influence Mapping: Students map idea development from prompt to final product, including LLM contributions.
Phase 5: Independent Ethical Application Goal: Support transfer of skills beyond the classroom.	• Personal AI Use Policy: Students write a personal or professional AI use philosophy, including boundaries, goals, and ethical considerations. • Field-Based AI Case Study: Students research AI use in their major or intended career and present ethical opportunities and challenges. • Policy Co-Design: In groups, students draft guidelines for responsible AI use, then present and justify their policies.

INSTRUCTOR STRATEGIES TO DEEPEN UNDERSTANDING OF LLM USE

Faculty mediation often determines whether AI functions as a shortcut that bypasses learning or as a cognitive partner that deepens it. Instructors play a pivotal role in shaping how students perceive and interact with LLMs. Their influence extends beyond teaching functionality: it involves modeling ethical awareness, critical thinking, and intentional engagement. In a constructionist classroom, where learners actively build their understanding through exploration and creation, instructors frame AI, not as a shortcut, but as a cognitive partner (Papert & Harel, 1991; Resnick, 2017).

One of the most effective strategies faculty can use is transparent modeling of LLM use. Rather than avoiding or obscuring AI use, instructors can openly demonstrate how they use LLMs for ideation, drafting, revision, or problem-solving. This reinforces the values of the Instructional Model for Human-Centered Generative AI Engagement, which prioritizes reflective, ethical, and dialogic interaction with LLMs. For example, instructors can craft and refine prompts, assess LLM-generated content, and iterate in real time, sharing their thought process aloud: "Here is why I phrased it this way" or "Let's see how the AI interpreted this prompt." These moments

model intentionality, discernment, and ethical awareness in action (Chan, 2023; Walter, 2024). When AI is used in this reflective, intentional way, it supports deeper learning, critical thinking, and repeated questioning (Arar, Özen, et al., 2025; Tlili et al., 2025).

The Prompt Literacy Cycle offers a practical structure for this type of modeling. As instructors guide students through the five recursive stages: clarify, craft, engage, refine, and reflect, they model the same process in their own work. This reinforces that LLM use is not about achieving perfection or efficiency, but about engaging thoughtfully and iteratively. Demonstrating how vague prompts produce generic results and how minor revisions can yield more nuanced responses helps students see the cognitive complexity involved in effective LLM use. This repeated engagement reflects the principle of human-machine symbiosis, the collaborative relationship in which human judgment guides the process while LLM capabilities extend and deepen thinking rather than replacing it (Arar et al., 2024).

Equally important is helping students understand when, why, and whether to use AI. Instructors can frame LLMs not merely as tools for convenience but as rhetorical and ethical instruments. By prompting students to articulate the intent of their LLM use and to reflect on its impact, faculty support the development of metacognition, academic integrity, and ethical reasoning (Chan, 2023; Walter, 2024). Instructors can share their own examples, such as using LLMs to brainstorm a lesson or assignment. This helps normalize responsible experimentation and use. Research shows intentional, context-aware AI use prevents misuse and encourages meaningful engagement (Mustafa et al., 2024).

Instructors empower students by building classroom norms for LLM use together. When instructors open dialogue about appropriate usage and limitations, students are more likely to take ownership of ethical practices. Collaboratively developed guidelines foster a culture of transparency, accountability, and care (Noddings, 2003). These discussions can also be linked directly to institutional academic integrity policies, helping students understand how authorship, attribution, and responsible LLM use intersect in academic work. When norm-setting is treated as a teaching moment rather than a compliance exercise, students develop a working understanding of authorship as something they actively construct and protect. Shared norms position ethical AI engagement as a collective responsibility rather than an individual choice, aligning with broader calls for unified and ethically grounded approaches to generative AI in education (Bozkurt et al., 2024).

Finally, instructors should underscore that while generative AI offers powerful support, it cannot replace human presence in learning. Relational elements such as feedback, encouragement, empathy, and cultural responsiveness remain irreplaceable, and this is not incidental to the framework — it is central to it. The Instructional Model for Human-Centered Generative AI Engagement is human-centered in name because it is human-centered in design. When educators use AI to enhance, not replace, their instructional role, they model a balanced approach that values both innovation and humanity (Arar, Özen, et al., 2025; Bixler & Ceballos, 2025).

Instructors function as critical mediators of AI literacy and classroom culture. By teaching AI use with openness and intention, they help students develop technical skills, reflective habits, and ethical awareness. Instructors help reposition generative AI not as a threat or shortcut, but as a meaningful extension of student-centered, values-driven learning.

CONCLUSION

As generative AI continues to evolve from an assistive technology to increasingly autonomous systems, higher education faces not only a pedagogical challenge but a structural one. Recent systematic evaluations suggest that AI's revolutionary potential lies in its capacity to promote active knowledge construction, but only when directed by deliberate pedagogy. The emergence of the "ghost student" and the risk of accumulating cognitive debt expose the limitations of reactive or prohibition-based approaches to AI. The response must be purposeful, proactive pedagogy: one that preserves human thinking and intellectual engagement at the center of the learning process.

In this manuscript, we introduced the Instructional Model for Human-Centered Generative AI Engagement, a constructionist framework designed to help instructors guide students in

engaging with LLMs as a thinking partner rather than a substitute for learning. By emphasizing prompt literacy, reflective engagement, and iterative learning processes, the framework supports instructors in integrating LLMs into teaching while maintaining student agency and intellectual ownership.

Through transparency, norm-setting, and thoughtful integration, educators can shape a culture in which generative AI serves as a springboard for inquiry rather than a replacement for thinking. As scholars increasingly call for assessment models that foreground human presence, reflection, and dialogic engagement over measurable output alone, this framework offers a practical and pedagogically grounded response: one designed not to resist AI but to ensure it cannot replace the learner.

As a conceptual framework, the model now invites empirical evaluation, which is currently underway. Future research should explore how this framework functions across diverse educational contexts. Empirical studies could test the model's effectiveness in supporting ethical and reflective AI engagement, examine disciplinary differences in generative AI use, and investigate how students perceive and develop prompt literacy over time. Additional research could also explore how faculty implement the framework across institutional contexts and how it intersects with evolving academic integrity policies.

These questions also connect to broader conversations in educational leadership. Scholars argue that meaningful AI integration requires ethical, equity-centered, and human-guided leadership across educational systems. While their work focuses on leadership at the school and system levels, the present study extends this conversation into higher education pedagogy by illustrating what human-centered AI engagement can look like within the classroom itself. As educational leadership scholarship emphasizes, the successful integration of AI depends not only on technological innovation but on ethical, equity-centered, and human-guided implementation across educational systems.

DATA ACCESSIBILITY STATEMENT

Data sharing is not applicable to this article as no datasets were generated or analyzed during the current study.

SUSTAINABLE DEVELOPMENT GOALS (SDGs)

This study is linked to the following SDGs: Quality Education (SDG 4).

COMPETING INTERESTS

The authors have no competing interests to declare.

AUTHOR CONTRIBUTIONS (CRediT)

April Joy Miles: Conceptualization, methodology, investigation, formal analysis, visualization, writing—original draft preparation, writing—review and editing;

Paige Haber-Curran: Conceptualization, resources, writing—original draft preparation, writing—review and editing;

Khalid Arar: Conceptualization, supervision, validation, project administration, writing—review and editing; All authors have read and agreed to the published version of the manuscript.

AUTHOR NOTES

Generative AI tools, including ChatGPT, Claude, Grammarly, and NotebookLM, were used during the development of this manuscript to support brainstorming, organization, language refinement, and editorial review. These tools assisted with drafting suggestions, improving clarity, and identifying areas for revision; however, all conceptualization, analysis, interpretation, and scholarly arguments were developed and evaluated by the authors. AI tools did not generate original research findings, conduct data analysis, or make intellectual contributions

that would qualify for authorship. Consistent with recommendations from the Committee on Publication Ethics (COPE), the authors assume full responsibility for the accuracy, originality, and integrity of the manuscript. All AI-assisted content was critically reviewed, revised, and approved by the authors prior to submission.

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TO CITE THIS ARTICLE:
Miles, A. J., Haber-Curran, P., & Arar, K. (2026). Prompts to Practice: A Pedagogical Framework for Human-Centered AI Engagement. *Open Praxis*, *18*(3), pp. 481–494. DOI: https://doi.org/10.55982/openpraxis.18.3.1191

Submitted: 18 March 2026
Accepted: 07 June 2026
Published: 04 August 2026