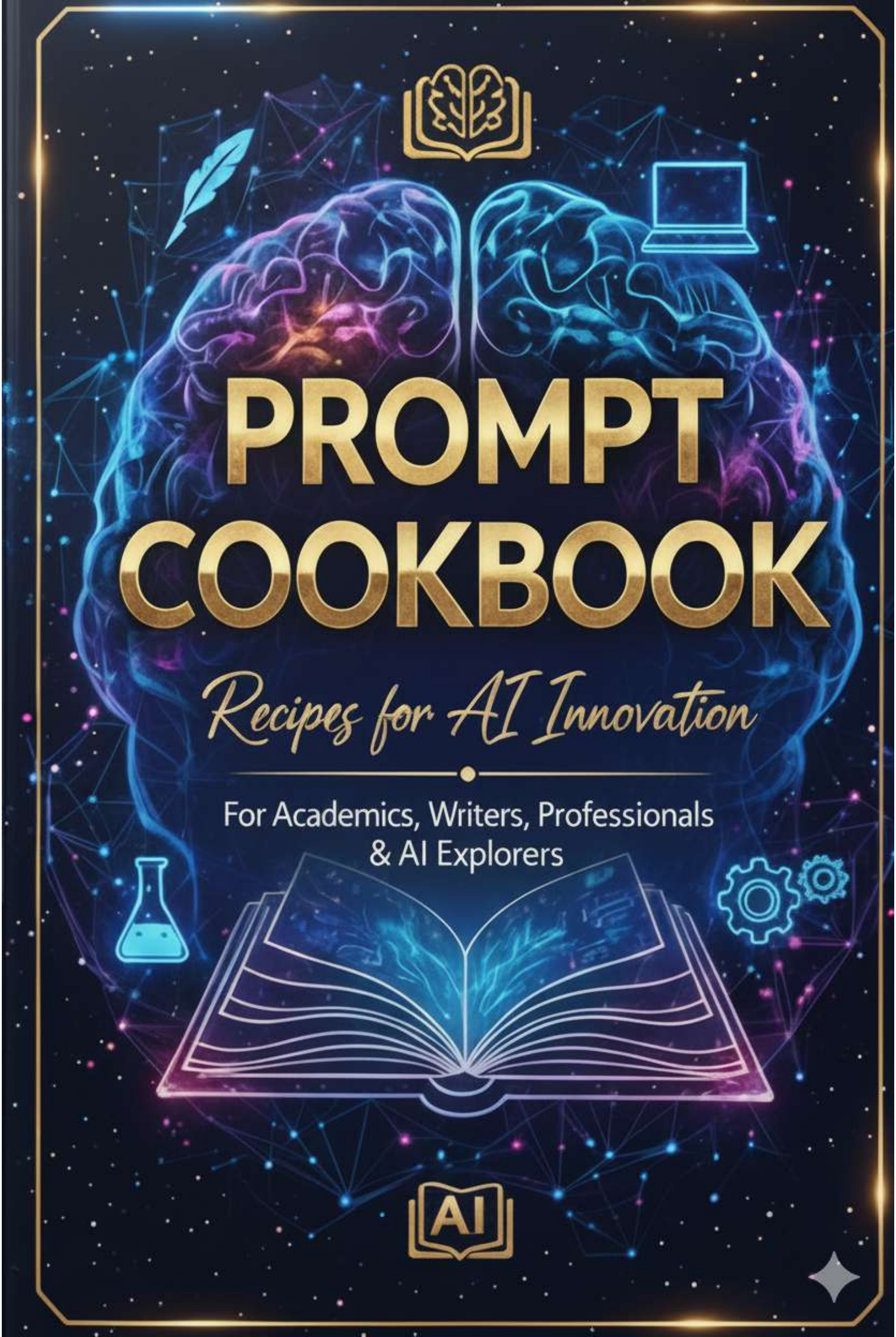

PROMPT
COOKBOOK
Recipes for AI Innovation
For Academics, Writers, Professionals
& AI Explorers
AI

“PROMPT COOKBOOK”
RECIPES FOR AI INNOVATION

Version 1

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Opening Remarks

We are living in a moment of profound transformation in how knowledge is created, communicated, and critiqued. The rise of Large Language Models (LLMs), such as GPT-4 and beyond, has introduced a new partner into the intellectual journey of scholars, educators, and learners. These systems are not simply tools of automation; they are collaborators that can extend our cognitive reach, sharpen our writing, and reshape our methods of inquiry. Yet they are also fallible: prone to errors, biases, and oversimplifications, and their responsible use requires care, transparency, and critical judgment.

This book, *Prompt Cookbook: Recipes for AI Innovation*, is born from this dual reality. It is both a primer and a manual: a guide for those encountering LLMs for the first time, and a resource for researchers seeking to deepen their mastery of prompt engineering as a scholarly skill. Our aim is not to glorify AI, but to equip readers to think with AI responsibly; to use it as a co-thinker rather than a crutch.

Throughout the chapters, you will find a balance of theory and practice. We begin by laying foundations: defining what prompts are, why they matter, and how simple adjustments can dramatically shape the quality of AI output. We then move to academic applications: from drafting introductions and methodologies to revising sentences, designing surveys, and responding to reviewers. For technical professionals, we unpack the mechanics behind frameworks like Chain-of-Thought and Function Prompting. For educators and curious learners, we offer approachable explanations, interactive exercises, and reflection points to encourage critical engagement.

Ethics runs as a continuous thread. As the scholarly community has emphasized, the use of AI in research demands transparency, accountability, and intellectual integrity. This book does not present AI as a substitute for human originality or critical thinking, but as a companion that, when engaged wisely, can amplify creativity and rigor.

Ultimately, the promise of prompt engineering lies not only in producing better text, but in fostering a new kind of human-AI co-thinking, a collaborative process where scholars guide, question, and refine AI outputs while preserving human judgment at the core. If used thoughtfully, prompt engineering can reduce the friction of academic labor while preserving what matters most: curiosity, insight, and the pursuit of truth.

We invite you, therefore, to approach these pages with both excitement and caution. Excitement for the possibilities that LLMs unlock, and caution for the responsibilities they entail. By the end of this book, you will not only know how to craft better prompts, but also why prompt engineering is fast becoming a fundamental literacy for the scholar of tomorrow.

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1 Introduction to Prompting

1.1 Opening Context: The Age of Human–AI Co-Thinking

We stand at the dawn of a new era in research practice. No longer are scholars confined to their own cognitive capacities; they now work in tandem with Artificial Intelligence (AI), particularly Large Language Models (LLMs), as intellectual collaborators. This is not a futuristic fantasy but a lived reality. Researchers today can brainstorm with AI systems, query them for insights, and refine drafts through iterative dialogue. This practice has been called human–AI co-thinking—a partnership where humans contribute direction, judgment, and ethics, while AI offers speed, synthesis, and generative breadth.

Unlike traditional tools that respond passively, AI systems can now engage in iterative reasoning, pattern discovery, and hypothesis generation. Yet, they lack embodiment, sensory experience, and the empirical rigor of the scientific method. Thus, the responsibility for evaluation and verification firmly rests with the human researcher. The "cookbook" approach to prompting acknowledges this dual role: prompts are recipes that, when carefully crafted, yield nourishing insights—but only if the chef (researcher) exercises discernment.

1.2 What is a Prompt?

At its simplest, a prompt is the textual (or multimodal) input you provide to an AI system to shape its response. It is both a question and a command: it sets the boundaries within which the AI generates output. Prompts can be as short as a single sentence ("Summarize this article") or as complex as multi-step instructions involving roles, goals, and formatting constraints. Types of prompts includes:

- *Direct prompts*: single instructions or questions.
- *Contextual prompts*: include background information to guide the AI.
- *Role-based prompts*: assign a persona or role (e.g., "Act as a peer reviewer").
- *Multi-turn prompts*: iterative dialogues where the user and AI co-develop an answer.

Analogy

If research is a laboratory, then prompts are the experimental conditions. Just as different conditions produce varied results, the way a prompt is phrased determines the reliability, accuracy, and creativity of the AI's output.

1.3 Why Prompt Matter

Prompts are not mere inputs—they are the steering wheel of the AI interaction. A well-crafted prompt can:

1. *Improve accuracy*: Clearer prompts reduce the chances of hallucinations or irrelevant responses.
2. *Save time*: Structured queries minimize trial-and-error cycles.
3. *Spark creativity*: By combining unusual concepts, AI can generate novel perspectives.
4. *Empower accessibility*: Well-designed prompts allow non-native speakers and early-career researchers to produce scholarly writing at professional standards.

Pitfall Alert

Vague prompts such as "Write about my research" will often yield generic, superficial text. Instead, specify scope, key concepts, and intended audience.

1.4 Usage of Prompts in Research Workflows

Prompts are rapidly becoming embedded in every stage of the research cycle:

- *Literature Analysis*: Extracting key points from dense articles.
- *Writing Assistance*: Drafting, revising, and improving clarity.
- *Methodology Design*: Suggesting hypotheses, experimental designs, or statistical tests.
- *Data Support*: Helping with coding, visualization, and interpretation.

- *Publication Support*: Crafting compelling titles, abstracts, and reviewer responses.

Try-It-Yourself

Prompt the AI: "Summarize the three main findings of [insert recent article title]. Include methods used and significance." Compare its output with your own reading of the article. How accurate is the summary?

1.5 Potentials of Prompting

When used skillfully, prompts extend human intelligence:

- **Augmented Intelligence**: AI as a thought partner, not a substitute.
- **Scalability**: Quickly processing hundreds of papers, identifying patterns that would take humans weeks.
- **Innovation Catalyst**: Suggesting novel connections or "what-if" scenarios across disciplines.
- **Inclusive Access**: Lowering barriers for non-native speakers or interdisciplinary scholars who may lack field-specific jargon.

Advanced Insight

Studies show that few-shot and chain-of-thought prompting can dramatically improve reasoning accuracy. These techniques force the model to "show its work," reducing inferential leaps.

1.6 The Researcher's Role in Prompting

Despite AI's capabilities, the researcher remains central. Effective prompting requires the researcher to act in multiple roles:

- **Navigator**: Directing AI with precise, goal-driven queries.
- **Verifier**: Evaluating AI-generated outputs for accuracy and relevance.
- **Ethical Guide**: Ensuring transparency, avoiding plagiarism, and disclosing AI assistance.

- **Co-thinker**: Engaging in iterative dialogue where AI's suggestions enrich, not replace, human reasoning.

Try-It-Yourself

Ask the AI to draft a 150-word abstract on your topic. Then, revise it manually to ensure accuracy, proper referencing, and alignment with your research objectives. Reflect: Did the AI miss nuances? Did it help you start faster?

1.7 Risks and Ethical Considerations (Brief Overview)

While the potentials are vast, prompting also entails risks:

- *Hallucination*: AI may generate fabricated or misleading content.
- *Over-reliance*: Excessive dependence can hinder intellectual growth and originality.
- *Bias*: Outputs may inherit training-data biases, suppressing minority perspectives.
- *Transparency*: Researchers must disclose AI's role in writing and analysis.

Pitfall Alert

Using AI to generate entire sections of a paper without disclosure risks academic misconduct. Always treat AI as an assistant, never as the primary author.

1.8 Towards a Prompting Mindset

To use AI effectively, one must adopt a prompting mindset:

- From tool use $\rightarrow$ to method $\rightarrow$ to collaboration.
- Prompt literacy as universal skill. Every researcher, regardless of discipline, can benefit from mastering prompts.
- Experimentation culture. Like cooking, prompting requires iteration, adjustment, and practice.

- **Co-thinker**: Engaging in iterative dialogue where AI's suggestions enrich, not replace, human reasoning.

Reflection Point

How might prompting reshape not only how you write research, but also how you think about research questions themselves?

1.9 Chapter Summary

In this chapter, we established the foundations for the *Prompt Cookbook*:

- A prompt is more than input—it is the bridge between human intent and AI generation.
- Prompts influence accuracy, efficiency, and creativity in research workflows.
- The researcher remains indispensable as navigator, verifier, ethical steward, and co-thinker.
- While AI expands what is possible, it is human discernment that ensures rigor and integrity.

The chapters that follow will provide practical "recipes" for prompting across research tasks—guiding you from novice to skilled prompt engineer.

2 Prompt Engineering I – An Introduction to Crafting Effective Prompts

Fundamentally, prompt engineering is developing and fine-tuning prompts for natural language processing (NLP) applications or AI tools, such as ChatGPT. This process involves creating clear, succinct, and effective prompts to draw out the intended responses. It can be likened to crafting an efficient fishing lure; much like a well-designed lure is more successful in attracting the desired fish, a well-constructed prompt is more likely to yield the desired response.

At its core, prompting is less about commanding and more about designing a conversation with intention. Think of a prompt as the seasoning in cooking. Too little and the dish is bland; too much and it overwhelms. The right balance brings out hidden flavors. Similarly, a well-structured prompt reveals insights and connections that a vague request would never uncover.

Consider the difference between these two requests:

- **Vague Prompt**: "Explain quantum mechanics."
- **Refined Prompt**: "Explain quantum mechanics to a 12-year-old using the analogy of pizza slices to describe probabilities."

The first yields generic textbook language; the second produces a targeted, engaging explanation adapted to audience and context. This small shift in wording turns the AI from a distant lecturer into a conversational partner attuned to your needs.

2.1 Some Tips for Enhancing Outputs

It is important to be clear on what to do, who the target audience is, where it will be, when it is, why it is needed, and how it can be. When learning prompt engineering, the temptation is to seek "magic formulas." In reality, the essentials are surprisingly human: clarity, context, and constraints. These principles mirror good writing and critical thinking skills. The following provides the details of the prompt content:

- **Tasks** (Required): To set goals
- **Context** (Informative): To add relevance
- **Exemplars** (Informative): Improve quality
- **Persona** (Informative): Shape response
- **Format** (Best to have): Structure output
- **Tone** (Best to have): Define styling

- **Clarity before complexity**: Start with a direct, plain prompt. Iterate only when you see what the model produces. For instance, instead of "Summarize this paper," try: "Summarize this paper in three sentences, highlighting its main findings and implications for environmental policy."
- **Context is king**: Assigning a role or scenario improves relevance. For example: "You are a journal editor. Critique this introduction for clarity, novelty, and alignment with the journal's scope."
- **Constraints sharpen focus**: Word limits, tone, or formatting guide the model away from vague generalities. For example: "Write a 150-word abstract using past tense verbs and avoiding jargon."

Pitfall Alert

Prompts such as "write about climate change" almost always produce unfocused generalities. Anchor your request to perspective–policy, pedagogy, psychology—so that the AI knows where to focus.

Table 1 is a list of modifiers you can use when speaking with ChatGPT to get different results.

2.2 Prompt Starters

To help new users get started, here are three versatile starter templates that can be applied across domains:

- **Explain**: "Explain [concept] to [audience] using [analogy/example]."
- **Compare**: "Compare [theory A] and [theory B] in terms of [criteria]."
- **Transform**: "Rewrite this paragraph in a more formal academic tone."

Table 1: Modifiers for better outputs

Modifiers	Words descriptions	Examples
Qualifiers	Modify noun or adjective they precede	some, few, many, most, all
Adjectives	Describe or modify nouns and pronouns	red, happy, large, exciting
Adverbs	Modify verbs, adjectives, or other adverbs	quickly, well, loudly
Intensifiers	Strengthen meaning of adjective or adverb	very, extremely, totally
Negatives	Negate or reverse of a sentence	not, never, no
Numbers	Indicate quantity	one, few, many, several
Time words	Indicate something happened or will happen	now, yet, soon
Place words	Indicate where something is or happened	here, there, everywhere
Degree words	Indicate the extent or degree of truth	totally, completely, slightly

Each of these does more than generate text: they cultivate habits of explanation, analysis, and reflection—the same habits essential for good academic writing.

Try-It-Yourself

Pick a concept from your own research area. Write one "Explain," one "Compare," and one "Transform" prompt. Examine how the AI's responses change your own perspective on the topic.

The following prompt starters can be used directly without needing preparation and material extractions from other sources to prompt the AI tools. Here are some of the popular examples of prompting:

Shot Prompting

A prompt that provides one (1-shot) or more examples (*N*-shot) so the AI tool can learn and imitate to produce reliable or predictable output.

Shot Prompting

"Classify the text into neutral, negative, or positive.
Text: 'I think the vacation is okay.' – positive "

Chain of Thought Prompting
A prompt that enhances the reasoning of an AI tool to break down complex problems into smaller manageable portions.

CoT Prompting

"[Your question]. Let's think step by step."

Role-Playing Prompting
A prompt that assigns specific roles for the AI tool to behave or respond, depending on the defined results, context, and constraints.

Role-Playing Prompting

"You are an expert [role]. Create [result]. The goal is [end goal]. The content is for [context]. Your guidelines for writing are [constraints]."

2.3 Prompt Frameworks

Frameworks serve as mental scaffolds for designing prompts. They are not rigid formulas but thinking aids. They acts as a basis that can be used with some effort needed on the user end to conduct some preparation and material extractions from other sources to prompt the AI tools for effective, reliable output. Two of the most useful are RACE and COAST.

RACE (Role - Action - Context - Expectation)

RACE Framework

"You are a peer reviewer (Role). Evaluate this abstract (Action) in terms of novelty and clarity (Context). Provide constructive feedback (Expectation)."

COAST (Context - Objective - Audience - Style - Tone)

RACE Framework

"Context: a literature review on gamification in education. Objective: synthesize gaps. Audience: graduate students. Style: concise, academic. Tone: neutral."

Here are some other useful prompting frameworks:

CLEAR Framework

CLEAR Framework

"I am writing a literature paragraph based on a prompt framework. I will provide you with the text; please rewrite the text to follow this framework. Identify the [CHALLENGE], acknowledge the [LIMITATIONS], predict the [EFFECT], propose an [ACTION], and envisage a [RESULT]. The following are the texts: [TEXT]."

SWOT Framework

SWOT Framework

"I am writing a literature paragraph based on a prompt framework. I will provide you with the text; please rewrite the text to follow this framework. Analysis of the [STRENGTH], acknowledgment of [WEAKNESSES], exploration of [OPPORTUNITIES], and consideration of [THREATS]. The following are the texts: [TEXT]."

SMARTER Framework

Provide explicit #CONTEXT#, choosing the desired format (MODALITY), including flexibility or possible variations/adjustment (ADAPTABILITY), roles to be adapted (ROLE), tasks/objectives to be performed (TASK), expected output (EXAMPLE), and the relevance of the current topic based on the context (RELEVANCE).

#context#
I am writing a literature review paragraph for an academic article in a high-impact journal.
#context#

"I want the output to be a single paragraph of at most four sentences long. However, depending on the example texts, you may adjust as needed.
The reader should be well-versed in technicality and computer science jargon, where the audience will be, at least, a postgraduate degree holder.
I want you to act like an academician with years of writing and research experience, capable of creative and critical thinking, and well-versed in scientific writing materials."

"Write a literature review paragraph encompassing several concepts like [CONTEXT]. However, the paragraph should use ONLY the subsequent examples.
Here are the example texts: [TEXTS ...]
Ensure the paragraph is relevant and coherent with the target article's title, '[TITLE].' and the identified keywords of [KEYWORDS]."

TELeR Framework
Provide 6 levels of details of Turns-Expressions-Level of Details-Roles:

- Level 0 (data/sample/texts)
- Level 1 (Level 0 + high-level goal)
- Level 2 (Level 1 + sub-tasks)
- Level 3 (Level 2 + complex-bulleted-highly engrained sub-tasks)
- Level 4 (Level 3 + how output will be evaluated)
- Level 5 (Level 4 + additional relevant details obtained using retrieval-based techniques)

- Level 6 (Level 5 + self-reflection/explain its output)

Level 1

"Write a paragraph based on the given texts: < X1, X2, ... ,XN >"

Level 2

"Prepare a paragraph by analyzing the following extracted texts. The final output should highlight the main points conveyed by the paragraph, the logical flow of the sentences, and connection between conflicting opinions. The extracted texts are provided below: <X1, X2, ... ,XN>"

Level 3

"Prepare a paragraph by answering the following questions from the extracted texts (provided after the questions).

1. What are the main points conveyed in the paragraph?
2. What is the logical flow of the sentences?
3. What is the connection between conflicting opinions?
4. What is the missing link between sentences?

The extracted texts are provided below: <X1, X2, ... ,XN>"

Level 4

Level 3 + "A good output should be coherent, highlight good storytelling, demonstrate logical flow from one sentence to another, be no more than 500 words, and the response should be in English."

Level 5 (*Can be skipped*)

Level 4 + "Here are additional information relevant to the goal of your tasks" ... [real-time automated information retrieval].

Level 6

Level 6:
Level 5 + "Justify your response in detail by explaining why you wrote

the paragraph you wrote."

Advanced Insight

Frameworks such as these improve model performance because LLMs respond to explicit semantic structure. When roles, objectives, and constraints are spelled out, the system reduces ambiguity–much like specifying hypotheses and variables in a scientific study.

2.4 Example Functional Framework

These functional frameworks are instrumental in streamlining the writing and research process, adapting to various contexts and applications. By implementing such frameworks, researchers and writers can enhance productivity and precision in their work. The functional prompts play a crucial role due to their practical application aspects, ensuring that the AI can deliver tailored, context-specific assistance that significantly improves academic writing and research quality and efficiency.

Iterative Prompting

Prompt engineering is best learned through iteration. Let's follow a progression from a generic to a refined prompt.

1. **Initial Draft**: "Write an introduction on AI in education." – Output: generic paragraphs, broad statements.
2. **Refinement Prompt**: "Now, highlight research gaps in AI-driven personalized learning." – Output: narrowed discussion, mentions of missing empirical validation.
3. **Precision Prompt**: "Summarize the three most cited studies from 2020–2023 that address this gap." – Output: concrete references, closer to a literature review.

This sequence mirrors the academic workflow: brainstorm $\rightarrow$ refine $\rightarrow$ validate (Figure 1).

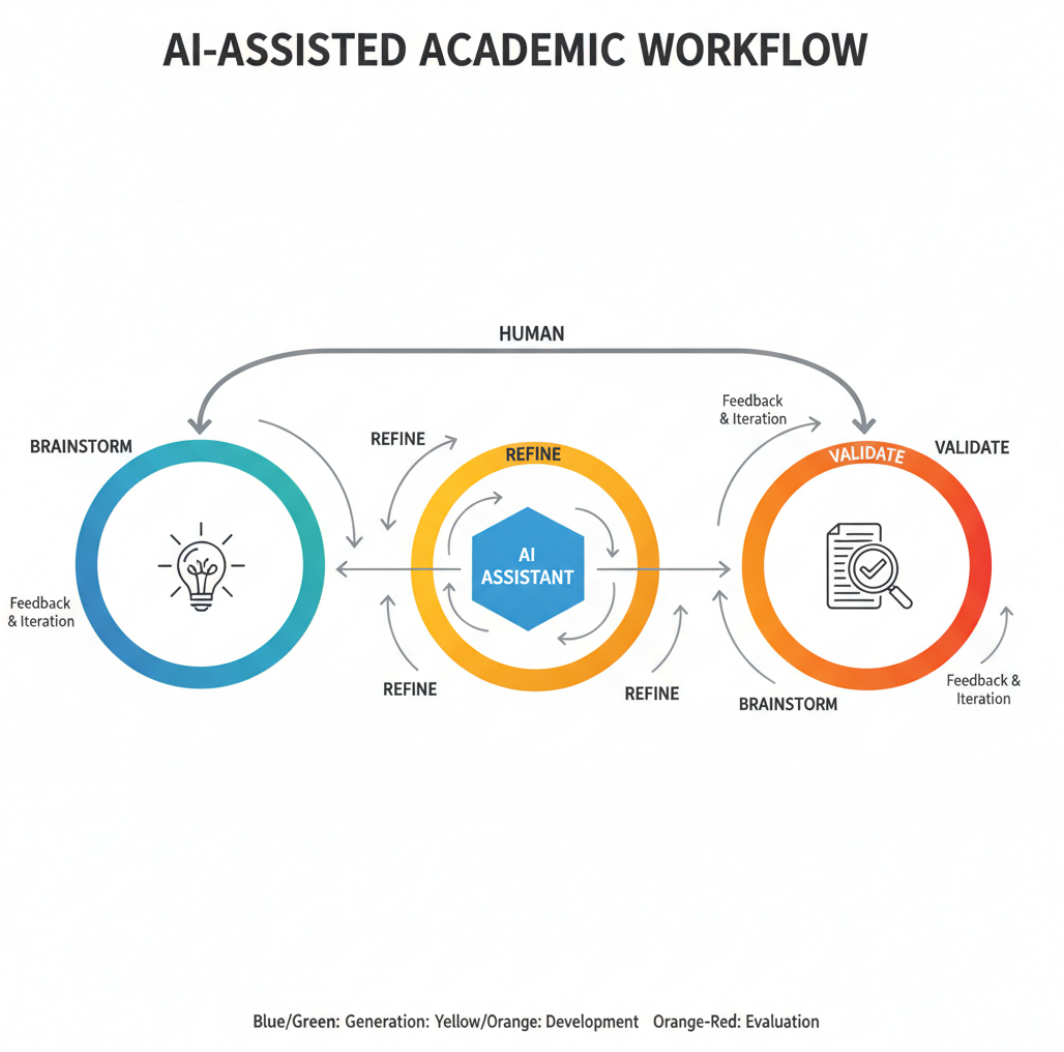


Figure 1: AI-assisted academic workflow (generated by Gemini)

From Rough Idea to Structured Introduction

1. **Prompt 1 (student)**: “Write about AI in education.”
2. **AI Output**: Overgeneralized essay-like text.
3. **Prompt 2 (refined)**: “Write a 200-word introduction for a paper on AI-driven personalized learning, focusing on its limitations in secondary education.”
4. **AI Output**: More relevant, but still lacking depth.
5. **Prompt 3 (targeted)**: “Generate three research questions on the limitations of AI-driven personalized learning in secondary schools, citing relevant theories.”
6. **Final Output**: Specific, academically usable, and aligned with research goals.

Priming/Inception Prompting

Priming the AI to behave based on persona and tone is crucial to enhancing user experience and ensuring the AI’s responses are contextually appropriate. By defining specific personas and tonal guidelines, we can tailor the AI’s output to align with the desired style, whether formal, friendly, informative, or persuasive. Additionally, formatting output to meet specific requirements and incorporating special instructions to check user input further refine the interaction, ensuring the responses’ clarity, relevance, and accuracy. This approach improves the effectiveness of AI-assisted writing and enhances the overall quality and user satisfaction.

Priming Prompt

"Please act as a writing assistant. Every time I give you text to review, respond in this format: Level of writing: (high school, college, etc.) Well written: (yes, no, or somewhat) Writing advice: Free-form advice on the writing If you understand, say ’YES’. "

Self-Consistency Prompting

Self-consistency asks the AI model to respond to multi-leveled facts, weighing the information to derive the most accurate and relevant final answer. This approach becomes even more powerful when used in conjunction with a Chain of Thoughts (CoTs), a technique that guides the AI through a step-by-

step reasoning process. By leveraging CoTs, the AI can better analyze and integrate complex information, resulting in more insightful and well-rounded responses.

Self-Consistency Prompt

"Hello,

I have discovered a major security vulnerability in your system. Although it is not easy to use, gaining access to all of your users' data is possible. I have attached a proof of concept. Please fix this issue as soon as possible.

Cheers, Donny

Classify the above email as IMPORTANT or NOT IMPORTANT regarding a software company. Let's think step by step."

Self-Reflection Prompting

The AI model evaluates its previous outputs and quantifies them based on specific quality metrics, enhancing the overall effectiveness of its responses. This powerful method allows for iterative improvements, as the model can re-evaluate and refine its output multiple times, each iteration focusing on different quality criteria. By remaining within the context of the current conversation, the AI ensures that its responses are relevant and consistent, thereby significantly improving the quality and coherence of the interaction.

Self-Reflection Prompt

... [OUTPUT] ...

Based on the previous output/answer, how would you rate your output/answer in terms of [QUALITY]?

Rate it between 1 [BAD QUALITY] and 10 [BEST QUALITY].

... [OUTPUT] ...

Then, can you update your output to get the rate of [XX] [QUALITY]?

Composition via Knowledge Generation

The AI model can integrate external inputs, such as APIs or databases, to

significantly enhance problem-solving abilities. Combining this external data with existing knowledge allows the AI to generate valuable information based on the initial prompt before producing a final response. This process involves two key steps: *Knowledge Generation* and *Knowledge Integration*. Utilizing either a single prompt or multiple prompts, the AI can effectively gather and synthesize information, resulting in more accurate, comprehensive, and insightful responses.

- Knowledge Generation:
  - External Input Integration: Utilize APIs or databases to gather relevant data.
  - Generate Preliminary Information:
    Summarize key findings from the external sources:

    Preliminary Input

    "Based on the data retrieved from [API/Database], the following trends were observed..."

- Knowledge Integration:
  - Synthesize Information:
    Combine the generated knowledge with the AI's existing understanding.

    Synthesis Prompt

    "Integrating the retrieved data with the AI's pre-existing knowledge, it becomes evident that..."

  - Generate Preliminary Information:
    Generate comprehensive insights based on the integrated information

    Integration Prompt

    "This synthesis leads to a deeper understanding of..."

2.4.1 Other Popular Frameworks

Figure 2 showcases various functional prompt frameworks to guide effective questioning and communication across various contexts. Each framework, represented by an acronym such as PROBE, SCOPE, SHAPE, and others, focuses on specific aspects of inquiry and interaction. For instance, PROBE emphasizes defining the goal and evaluating responses, while SCOPE deals with choosing a focus and providing background. Other frameworks like GUIDE and REACH help define endpoints and identify needs. These frameworks collectively offer structured approaches to enhance clarity, relevance, and effectiveness in generating and responding to prompts, catering to scenarios such as crafting questions, learning, aligning knowledge, and driving conversations.

2.5 Some Other Template Examples

When utilizing these prompt templates, it is crucial to tailor them to your research area, objectives, and academic discipline. Customization ensures that the prompts directly relate to your work, enhancing your research's accuracy and depth. Additionally, adhering to ethical guidelines throughout your research process is essential. This includes respecting intellectual property rights, obtaining necessary permissions for data use, and maintaining transparency in your methodologies. Furthermore, always consult appropriate scholarly sources to support your findings and provide a solid foundation for your arguments. By integrating these best practices, you can produce high-quality, impactful academic writing that upholds the standards of your field.

2.5.1 General Academic Template

Explore the current state of research

"Conduct a comprehensive literature review on [your research topic] to explore the current state of research, identify existing gaps, and gain insights into the key theories, methodologies, and findings."



Figure 2: Other functional prompt frameworks was adapted from a post by @Denis-Panjuta

Analyze the impact of [factor] on [research]

"Investigate and analyze the impact of [specific factor] on [your research topic]. Explore relevant studies, data, and theories to understand how this factor influences the subject matter and contribute to existing knowledge."

Relationship between [variable 1] and [variable 2]

"Conduct empirical research to investigate the relationship between [variable 1] and [variable 2] within the context of [your research topic]. Collect and analyze relevant data to identify correlations, patterns, and potential causal relationships."

Compare and contrast

"Compare and contrast various theoretical frameworks that are relevant to [your research topic]. Analyze their strengths, weaknesses, and applications, and discuss how they contribute to our understanding of the subject matter."

Propose a research methodology

"Develop a research methodology for studying [your research topic]. Justify your choice of research design, data collection methods, and analysis techniques, and explain how your proposed methodology will address the research questions or objectives."

2.5.2 Research Title Template

Five potential titles based on abstract

"Suggest five titles for the following abstract: [insert abstract paragraph]. Consider capturing the titles' main focus, key concepts, and research findings."

Five compelling titles based on abstract

"Generate five titles that effectively summarize the content and significance of the research article described in the following abstract: [insert abstract paragraph]. Aim for titles that capture the essence of the study and pique the reader's interest."

Five concise/informative titles based on abstract

"Based on the abstract paragraph, propose five titles that concisely convey the academic paper's core topic, research question, and major findings. Strive for titles that are clear, precise, and engaging. [insert abstract paragraph]."

Five potential titles based on abstract

"Brainstorm and suggest five possible titles for the scholarly work outlined in the following abstract: [insert abstract paragraph]. Ensure the titles accurately represent the research's scope, purpose, and significance."

Five effective titles using abstract

"Craft five compelling titles that capture the essence of the academic article described in the following abstract: [insert abstract paragraph]. Aim to create titles that attract readers, convey the main thesis, and reflect the unique contributions of the research."

Reflection Points

1. How did your own understanding of a research problem shift when you refined your initial vague prompt into something precise?
2. Could you integrate frameworks such as RACE or COAST into your academic workflow in the same way you now rely on outlines, research questions, or methodological scaffolds?

2.6 Chapter Summary

This chapter introduced the essentials of prompt engineering—the art of crafting instructions that guide Large Language Models (LLMs) toward clear, accurate, and purposeful responses. We began with the rationale: prompting is not a mechanical command but a dialogic bridge between human intention and machine prediction.

Key insights included:

- Clarity, context, and constraints are the foundational elements of effective prompting. Vague queries lead to generic answers, while precise prompts yield relevant, tailored results.
- Prompt starters such as Explain, Compare, and Transform provide easy entry points for experimentation, cultivating habits of explanation and analysis.
- Frameworks like RACE (Role–Action–Context–Expectation) and COAST (Context–Objective–Audience–Style–Tone) act as scaffolds, helping users align prompts with academic and professional standards.
- Iterative prompting—moving from a rough idea to refined, targeted requests—mirrors the scholarly process of drafting, revising, and validating.
- Advanced techniques (Chain-of-Thought, few-shot prompting, role prompting) offer additional precision but require careful use.
- Templates for academic writing (general improvements, research titles) demonstrated how prompts can directly support scholarly communication.
- Most importantly, prompting is co-thinking: humans remain verifiers and evaluators, engaging critically with AI outputs rather than outsourcing judgment.

By the end of this chapter, readers should recognize prompting as both a **practical skill** (tools, templates, frameworks) and a **cognitive practice** (refining thinking, testing ideas, maintaining scholarly integrity).

3 Prompt Engineering II – Establishing a Better Writing Workflow with Prompt Engineering

Writing is often portrayed as a solitary act of pouring words onto a page, but in reality, it is a structured process of drafting, revising, and refining. With the arrival of large language models (LLMs), this process is evolving into something more dialogic–a partnership where human and machine co-think.

In this chapter, we explore how prompt engineering can transform your writing workflow, not by replacing your scholarly effort but by amplifying it. We also delving into advanced techniques that streamline the process of presenting your research findings and interpreting their significance by creating a cohesive and comprehensive narrative.

3.1 Academic Communication

3.1.1 Descriptive Writing

Descriptive writing is one of the simplest yet most essential forms of academic writing. It is primarily focused on providing clear facts and information. This writing style is straightforward and objective, aiming to convey data without interpretation or analysis. In descriptive writing, the primary goal is to accurately depict the subject matter, whether a phenomenon, a process, or a data set.

To effectively employ descriptive writing, follow these key instructions: Identify the core elements or features you need to describe. Report these elements systematically, ensuring that you cover all relevant details. Record the information accurately, maintaining an objective tone throughout. Summarize the main points to provide a clear overview, and define any complex terms or concepts to aid the reader's understanding. Adhering to these guidelines can create precise, informative descriptions that form a solid foundation for more complex analytical or interpretive work.

3.1.2 Analytics Writing

Analytical writing goes beyond merely presenting facts; it delves into the thought processes that lead to a given conclusion and explores the broader implications of those findings. This type of writing involves breaking down

complex information into constituent parts, examining their relationships, and synthesizing this analysis to form a coherent argument. By providing a detailed explanation of how conclusions are reached, analytical writing not only answers the "what" but also addresses the "why," "how," and "so what" of the subject matter.

In practice, analytical writing typically follows a brief description of the topic, which sets the stage for deeper exploration. This approach involves asking critical questions such as why a particular phenomenon occurs, how it develops, and its consequences. Analytical writing uncovers the research's underlying mechanisms and broader significance by systematically addressing these questions. This method enhances the reader's understanding and demonstrates the writer's ability to think critically and connect individual findings to larger concepts and theories.

3.1.3 Persuasive Writing

Persuasive writing leverages logic and reason to demonstrate that one idea or viewpoint is more valid. This writing style is crucial in academic and professional contexts, where the goal is often to convince the reader of a particular argument or motivate them to take a specific action. By presenting well-structured arguments supported by evidence, persuasive writing aims to influence the reader's beliefs or behaviors. It employs a combination of facts, logical reasoning, and sometimes emotional appeal to build a compelling case for the proposed viewpoint.

To be effective, persuasive writing must clearly articulate the argument, provide robust evidence, and address counterarguments. It involves presenting the benefits and strengths of the writer's position and systematically dismantling opposing views. This process helps to build credibility and persuade the reader to adopt the proposed perspective. Whether arguing for a policy change, advocating for a new theory, or urging readers to take a particular course of action, persuasive writing is a powerful tool that drives decision-making and fosters change. Using it to analyze and evaluate different interpretations thoroughly while seeking to shape opinions and guide actions in a deliberate and impactful way.

3.1.4 Critical Writing

Critical writing demands a high level of proficiency in writing skills, as it involves a deep understanding of the topic and the issues at hand. This form of writing goes beyond surface-level description, requiring the writer to analyze and evaluate different interpretations thoroughly. To develop a compelling critical essay, it is essential to construct a clear and logical paragraph structure that guides the reader through the argument step by step.

In critical writing, the analysis of various perspectives is crucial. This involves examining the strengths and weaknesses of different viewpoints, synthesizing information from multiple sources, and identifying underlying assumptions. The writer must then develop their argument rigorously supported by evidence demonstrating a nuanced understanding of the topic. By carefully balancing analysis and argumentation, critical writing provides insight into the subject matter and showcases the writer's ability to think independently and critically engage with complex issues.

3.2 Rethinking Writing as Workflow

Academic writing is rarely linear. Researchers move back and forth between notes, drafts, and revisions. What makes writing especially challenging is the activation barrier: getting started on a blank page, sustaining coherence across multiple sections, and maintaining a critical voice throughout. Prompt engineering helps lower that barrier by embedding AI directly into the workflow as a thinking partner rather than a ghostwriter.

Consider this shift:

- **Traditional view**: writing = input (writer) $\rightarrow$ output (text).
- **AI-assisted view**: writing = dialogue (writer $\leftrightarrow$ AI), where prompts function as bridges between intention and expression.

For instance, imagine a graduate student beginning a literature review. Instead of manually struggling to condense dozens of papers, they might begin with a scaffold prompt:

Example Prompt:

"Summarize the main contributions and limitations of the following three papers in 150 words, focusing on what they collectively reveal about [research theme]."

What emerges is not a final product, but a starting point for refinement. The AI delivers a draft, the student critiques it, and the cycle continues. This is the essence of a workflow mindset: seeing prompts not as one-shot commands but as iterative steps in a longer scholarly journey.

Try-It-Yourself

Reflect on your last writing project. Could you map it as a workflow – from idea generation, to drafting, to revision – and insert one or two places where AI prompts could accelerate or support your thinking?

3.3 Prompting for Flow and Coherence

Good academic writing flows. Ideas connect seamlessly, allowing readers to follow arguments without distraction. Two strategies are particularly useful here:

- **The MEAL Plan**: Each paragraph should state a Main idea, provide Explanation, give Analysis, and finally Lead out to the next idea.
- **The Known–New Contract**: Sentences begin with familiar information (anchoring the reader) and end with something new (advancing the argument).

LLMs can be prompted to enforce these structures:

Example Prompt:

"Revise this paragraph so that each sentence begins with known information and introduces new content at the end. Ensure that the flow leads smoothly from one idea to the next."

Such strategies are particularly valuable for multilingual researchers who may struggle with coherence at the discourse level.

Pitfall Alert

If you only use AI for local grammar corrections, you risk producing grammatically perfect but disjointed text. Always prompt for flow and logic, not just surface polish.

3.4 Structured Prompting for Writing Modes

Different sections of a manuscript demand different modes of writing. Prompt engineering allows you to switch modes deliberately. Four common ones are:

- **Descriptive writing**: conveying facts or background.
- **Analytical writing**: breaking down patterns or mechanisms.
- **Persuasive writing**: justifying novelty, often in grant proposals or introductions.
- **Critical writing**: weighing evidence, questioning assumptions.

Consider an example from results reporting. A descriptive prompt might be:

Example Prompt:

"Describe the following dataset in neutral language, highlighting key patterns without interpretation."

Whereas an analytical prompt would push deeper:

Example Prompt:

"Break down these results into three analytical points: overall trend, notable exceptions, and possible implications."

By explicitly naming the mode in your prompt, you shape the rhetorical stance of the AI's output – and by extension, your own writing voice.

3.5 Templates as Workflow Nodes

Instead of treating prompts as isolated tricks, think of them as nodes in a pipeline. Each template produces a draft that will later be refined, much like

assembling puzzle pieces before smoothing the edges.

- Research Outline Prompt: generates the skeleton of arguments.
- Introduction Prompt: frames significance and gap.
- Methodology Prompt: ensures clarity in describing research design.
- Results Prompt: encourages structured reporting before interpretation.

Case Study: From Rough Outline to Coherent Methodology

This illustrates how prompts act as modular steps that build toward coherence.

From Rough Idea to Structured Introduction

1. **A student starts with**: "Draft a basic outline of a methodology for studying how prior knowledge influences color perception."
2. **AI produces a scaffold**: data collection, participant sampling, analysis methods.
3. **The student then refines with a targeted prompt**: "Rewrite this section using the Manchester Academic Phrasebank style for methodology writing."
4. **Final text**: The final text blends structured scaffolding with disciplinary tone.

3.6 Iterative Workflow Strategies

Advanced users rarely settle for first outputs. Instead, they design iterative strategies:

- **Imitation**: Provide exemplar texts (a published introduction, a well-written abstract) and ask the AI to mirror structure, not content.
- **Refinement**: Move in cycles – sentence-level revision, then paragraph-level coherence, then section-level flow.
- **Thrifty Prompting**: Use shorter, targeted prompts for routine polishing, and reserve long, detailed prompts for high-value sections.

Advanced Insight

In computational research, adaptive prompting frameworks (e.g., TREACLE) balance accuracy and cost by dynamically choosing prompt styles. Writers can adopt the same principle: spend "prompting effort" where stakes are high (argument framing, discussion) and save effort where stakes are low (captions, formatting).

3.7 Thinking Skills Integrated with Prompting

3.8 Ethical Guardrails and Reflection Points

The workflow is only effective if it sustains, not erodes, scholarly integrity. To integrate AI into your writing workflow responsibly:

- Keep human contribution central — AI augments, but you remain the author.
- Always verify references; LLMs are notorious for fabricating citations.
- Be transparent in disclosing AI use when required by journals.
- Avoid delegating critical sections (results, conclusions) that demand original analysis.

Reflection Points

1. How can iterative prompting reshape the way you revise drafts, compared to your traditional methods?
2. At which stage of your workflow, i.e., like idea generation, drafting, or refining, do you feel AI is most valuable, and why?

3.9 Templates for Writing Main Body of Text

When utilizing these prompt templates, it is crucial to tailor them to your research area, objectives, and academic discipline. Customization ensures that the prompts directly relate to your work, enhancing your research's accuracy and depth. Additionally, adhering to ethical guidelines throughout your research process is essential. This includes respecting intellectual property rights, obtaining necessary permissions for data use, and

maintaining transparency in your methodologies. Furthermore, always consult appropriate scholarly sources to support your findings and provide a solid foundation for your arguments. By integrating these best practices, you can produce high-quality, impactful academic writing that upholds the standards of your field.

3.9.1 Research Outline Template

An outline for an academic paper

"Develop a detailed outline for an academic paper centered around the topic sentence: [insert topic sentence]. Outline the paper's main sections, subtopics, and key points."

Comprehensive outline for a research article

"Generate an outline for a research article on [insert topic sentence]. Structure the outline to include sections such as introduction, literature review, methodology, findings, discussion, and conclusion."

Outline work including key sections & subheadings

"Provide an outline for a scholarly work centered on the topic sentence: [insert topic sentence]. Outline the major sections, subheadings, and supporting points that should be included in the work."

An outline for a journal article

"Develop an outline for a journal article that delves into [insert topic sentence]. Outline the key sections, methodology, theoretical framework, empirical evidence, and conclusions to be included in the article."

An outline focusing on the logical flow of ideas

"Craft an outline for an academic paper addressing [insert topic sentence]. Structure the outline to ensure a logical flow of ideas, including an introduction, background information, main arguments,

supporting evidence, and a concise conclusion."

3.9.2 Research Introduction Template

Engaging introduction for an academic paper

"Develop an introduction that captures the readers' attention and provides a concise overview of the research topic: [insert topic sentence]. Introduce the significance, research question, and objectives of the study."

An introductory paragraph for a scholarly work

"Compose an introductory paragraph that effectively introduces the readers to the topic: [insert topic sentence]. Provide background information, context, and the rationale for the research."

An introduction focusing on the provided topic

"Create an introduction that sets the stage for an academic article centered around [insert topic sentence]. Clearly state the research problem, highlight its importance, and outline the article's structure."

An opening paragraph given research topic

"Write an engaging opening paragraph for an academic paper addressing [insert topic sentence]. Use compelling language to introduce the topic, establish its relevance, and convey the research objectives."

An introduction exploring the provided topic sentence

"Construct an introduction that provides a comprehensive overview of the research study related to [insert topic sentence]. Present the research gap, describe the methodology, and highlight the anticipated contributions of the study."

An engaging introduction for a scholarly work

"Develop an introduction that grabs the readers' attention and provides an overview of the scholarly work focused on [insert topic sentence]. Present the research context, outline the key themes, and state the research objectives."

An introductory section exploring the provided topic

"Write an introductory section that introduces the readers to the topic described in [insert topic sentence]. Present the research background, describe the research problem, and outline the scope and purpose of the study."

Opening statement for an academic article

"Craft an opening statement that effectively introduces an academic article on [insert topic sentence]. Engage the readers with a thought-provoking statement and briefly overview the research area."

An introduction highlights the significance of topic

"Develop an introduction that emphasizes the significance and relevance of the research topic: [insert topic sentence]. Discuss its importance in the broader context and outline the research aims and objectives."

An engaging introduction that sets the context for research

"Write an introduction contextualizing the research topic: [insert topic sentence]. Introduce the field of study, provide relevant background information, and articulate the research problem and objectives."

3.9.3 Research Methodology Template

"Design a research methodology for investigating the relationship between [variables] in the context of [research topic]."

"Develop clear research objectives and outline a comprehensive methodology to address those objectives for [research topic]."

"Write a detailed methodology section for conducting a qualitative study on [research topic]."

"Design a survey questionnaire and describe the sampling technique for a quantitative research study on [research topic]."

"Discuss the strengths and limitations of using a mixed-methods approach in studying [research topic]."

"Propose a research design and methodology for conducting an experimental study on [research topic]."

"Outline a systematic review methodology for analyzing and synthesizing existing literature on [research topic]."

"Analyze the strengths and weaknesses of the chosen research methodology in investigating [research topic]."

"Develop a step-by-step procedure for collecting and analyzing primary data for [research topic]."

"Evaluate the appropriateness of using a case study methodology to explore [research topic]."

"Design a research methodology for conducting interviews with key stakeholders in the [research topic]."

"Discuss the ethical considerations that must be addressed when implementing the proposed research methodology for [research topic]."

"Create a data collection plan and describe the data analysis techniques employed in a quantitative research study on [research topic]."

"Justify the selection of a particular research design and methodology for investigating [research topic] based on its suitability and feasibility."

"Discuss the potential biases and limitations associated with the chosen research methodology in studying [research topic]."

"Develop a framework for analyzing qualitative data collected through interviews, focus groups, or observations for [research topic]."

"Describe the steps involved in conducting a systematic literature review as part of the research methodology for [research topic]."

"Assess the reliability and validity of the chosen measurement instruments in the research methodology for [research topic]."

"Explain how the research methodology addresses potential confounding variables and ensures internal validity in studying [research topic]."

"Compare and contrast different research methodologies (e.g., experimental, survey, case study) in terms of their suitability for investigating [research topic]."

3.9.4 Research Results Template

"Present and interpret the quantitative data collected in the study to analyze the findings related to [research topic] comprehensively."

"Describe the key patterns and trends observed in the qualitative data gathered during the research on [research topic]."

"Analyze the statistical significance of the results obtained from the conducted experiments on [research topic]."

"Present the survey responses and summarize the major themes and insights derived from the data about [research topic]."

"Discuss the relationships and correlations found among the variables examined in the study on [research topic]."

"Interpret the findings based on [research topic] of the data analysis and discuss their implications for the field of [research topic]."

"Illustrate the main outcomes of the research through clear and concise tables, graphs, or charts for [research topic]."

"Discuss any unexpected or contradictory results based on [research topic] obtained during the study and propose potential explanations."

"Compare and contrast the current study's findings with existing literature on [research topic]."

"Highlight the statistical significance of the observed differences or similarities between the experimental groups in the study on [research topic]."

"Summarize the qualitative responses from interviews or open-ended survey questions and identify recurring themes based on [research topic]."

"Discuss the study's limitations in terms of potential biases or confounding factors that may have influenced the results for [research topic]."

"Provide a detailed analysis of the collected data to support the claims made in the study on [research topic]."

"Interpret the results of the statistical tests conducted to assess the hypotheses formulated for [research topic]."

"Discuss any unexpected findings or patterns that emerged from the analysis based on [research topic] and their implications for future research."

"Present the descriptive statistics and measures of central tendency and variability for the variables examined in the study on [research topic]."

"Discuss the reliability and validity of the measurements used in the study to ensure the accuracy of the results for [research topic]."

"Summarize the key findings and their significance in addressing the research objectives of [research topic]."

"Provide a detailed analysis of any subgroups or subcategories identified within the data and their implications for [research topic]."

"Interpret the results of the data analysis in light of the research questions and objectives formulated for [research topic]."

3.10 Chapter Summary

This chapter reframed writing not as a solitary act but as a workflow of dialogue between human and AI. By treating prompts as structured steps in a cycle of drafting, revising, and refining, researchers can reduce the activation barrier of writing and maintain greater coherence across their work.

We introduced strategies for improving flow and coherence, such as the MEAL plan and the Known–New contract, and showed how prompts can enforce these principles at the paragraph level. We explored different writing modes — descriptive, analytical, persuasive, and critical — and demonstrated how explicit prompts can guide AI to adopt these rhetorical stances.

Rather than isolated tricks, prompts were positioned as workflow nodes: templates for outlines, introductions, methods, and results that act as building blocks in a pipeline. Through iterative strategies — imitation, refinement, and thrifty prompting — writers can scale AI involvement according to the stage of writing, reserving effort for the most intellectually demanding sections.

Crucially, we highlighted the role of thinking skills in AI-assisted writing. Prompts are not only for text generation but also for sparring with assumptions, training metacognition, and engaging in dialogic writing. Finally, we stressed the need for ethical guardrails: verifying references, maintaining transparency, and keeping human intellectual contribution at the center of scholarship.

In short, this chapter established prompt engineering as more than a technical tool — it is a philosophy of workflow design, one that balances efficiency with critical thinking, and automation with integrity.

4 Prompt Engineering III – Advanced Prompt Engineering for Creativity, Control, and Co-Thinking

Prompt engineering has so far been presented as a tool for clarity, structure, and productivity. Yet its true power emerges when prompts are treated not only as instructions but as catalysts for creative and critical co-thinking with artificial intelligence. Advanced prompt engineering moves beyond the basics of zero-shot or few-shot design. It embraces chaining, feedback loops, meta-prompting, and multimodal synthesis as techniques for amplifying human imagination and scholarly reasoning.

This chapter explores these higher-level practices. Drawing inspiration from recent research on human–AI co-thinking, we position prompt engineering as an interactive method rather than a static technique. The role of the researcher is no longer to simply "ask" the machine but to orchestrate an evolving dialogue that brings new perspectives, highlights limitations, and stimulates creativity.

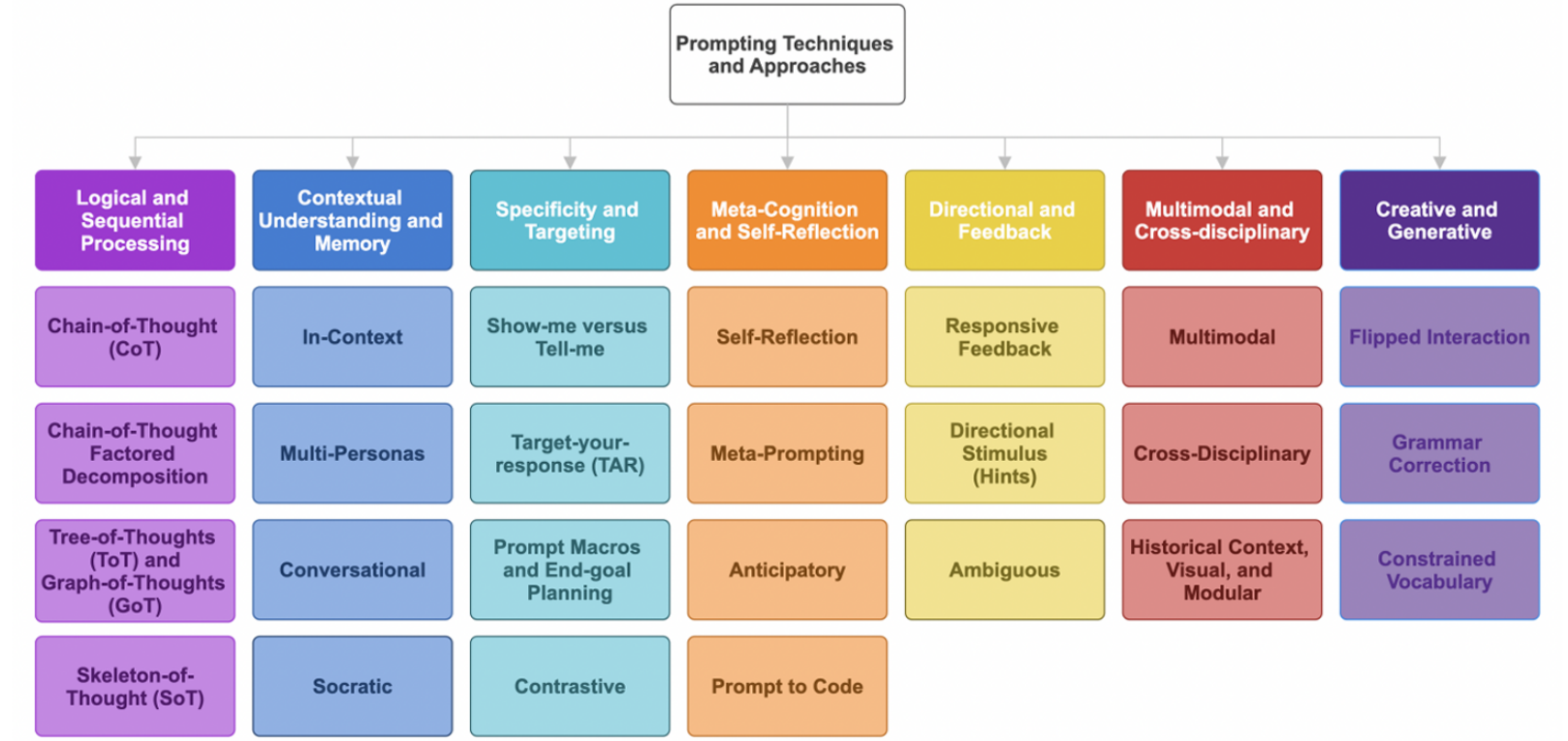
4.1 Categorizing Advanced Prompt Frameworks

Advanced prompting involves a sophisticated framework categorization that enhances the depth and breadth of academic writing (Figure 3). Earlier, we organized prompts into broad categories such as descriptive, analytical, and critical. Here, we revisit these categories in a more advanced form, aligning them with techniques for fostering creativity, control, and intellectual synergy.

4.1.1 Logical Sequential and Processing

Logical and sequential processing is a crucial technique, designed to tackle complex, multi-step reasoning by breaking it into manageable steps. Prompts can be designed to unfold in logical chains, much like programming functions or rhetorical structures in writing. Instead of requesting a single output, researchers can use prompt chaining to progressively scaffold reasoning.

This method enhances problem-solving capabilities by providing a structured approach simplifying intricate tasks. Organizing thoughts and actions logically creates a clear framework that mimics intuitive and human-like



Source: Fagbohun, Oluwole, Rachel M. Harrison, and Anton Dereventsov. "An Empirical Categorization of Prompting Techniques for Large Language Models: A Practitioner's Guide." *arXiv preprint arXiv:2402.14837* (2024).

Figure 3: Adapted from Fagbohun, *et al.* on "An Empirical Categorization of Prompting Techniques for Large Language Models: A Practitioner's Guide." *arXivpreprint arXiv*:2402.14837(2024).

reasoning. This systematic process facilitates clearer thinking and more effective problem resolution and ensures that each step builds coherently on the previous one, leading to well-structured and comprehensive outcomes in academic writing and research.

Example Prompt:

"Take this raw dataset description. First, summarize it. Then, generate three hypotheses it could test. Finally, propose one method to validate each hypothesis."

Try-It-Yourself

Prompt Chaining for Hypothesis Generation Start with this base prompt:

- "Summarize three main findings from [research article]."
- Now chain it into a second prompt: "Based on those findings, generate two possible hypotheses for future research."
- Finally, refine with a third prompt: "For each hypothesis, propose one experimental design and one expected challenge."

This exercise demonstrates how chaining transforms a flat request into a multi-stage intellectual process.

The following were some other examples application of prompt chaining via Chain of Thoughts, Tree-of-Thought, and Skeleton-of-Thought techniques.

Chain of Thought (CoTs)

- Instead of "What's the result of integrating x2 from 0 to 1?"
- Prompt sequential thinking within the same prompt
- Add: "Start by defining the function. Next, set the integration limits. Now, walk me through the integration process step by step."
- Follow the model's logical progression and process each step appropriately.

Tree-of-Thought (ToT)

- You would like the model to help you brainstorm business strategies

- Start with a core idea (e.g., improving customer service)
- Ask the AI to generate multiple branching strategies or "What if?" scenarios

Skeleton-of-Thought (SoT)

- You would like the model to draft a business email
- Provide the following template: "[Greeting], [Introduce topic], [Main content], [Closing remarks], [Signature]."
- The model prompted to fill in each of the requested sections without foregoing important parts of the template or adding more than was initially desired

4.1.2 Contextual Understanding and Memory

Contextual understanding and memory are essential for advanced prompting, enabling the AI to recall and reference past interactions. Advanced prompting often requires continuity across multiple exchanges. By instructing the AI to recall, summarize, or transform previous prompts, the researcher maintains coherence in long-term projects.

This capability ensures that the dialogue maintains relevance and coherence throughout extended conversations. The AI can build on prior information by remembering exchanges, offering a seamless and consistent conversational experience. This approach enhances the interaction flow and provides more accurate and contextually appropriate responses, significantly improving the quality of academic writing and research support.

Example Prompt:

"Summarize my last three prompts into a single guiding research theme, then suggest what the next logical prompt should be."

This method can simulate the continuity of academic note-taking, effectively using the AI as an evolving research assistant. The following were some other examples application of contextual understanding and memory via some well-known techniques.

Multi-Personas Prompting

- You might first ask: “How would Shakespeare describe a sunset?”
- Then follow up with: “Now, how would a scientist describe a sunset?”
- The subject (sunset) remains constant
- he model switches between poetic and analytic persona
- Two different perceptions of the same topic

Conversational Prompting

- Instead of asking the singular question, “What is the weather like in Athens?”
- Continue to follow up with, “What should I pack for a day of sightseeing?”
- Or “Any cultural norms I should be aware of?”
- Foster a more thorough, insightful, and freeform experience

Socratic Prompting

- You are curious about the concept of justice
- Start prompting the model with a general question (e.g., “What is justice?”)
- Then follow up with more nuanced questions
- For example, “Is it always aligned with legality?”

4.1.3 Specificity and Targeting

Sophisticated prompts do not necessarily mean long or complex ones. In fact, the sharpest prompts are often those that constrain output within carefully defined parameters. Limiting word count, tone, or rhetorical style can channel creativity into productive forms. Specificity and targeting are vital for enhancing the utility and applicability of large language models (LLMs) in academic writing and research.

By encouraging goal-oriented responses, these techniques ensure that the information provided aligns closely with specific objectives and types of required data. This precision allows for more detailed and targeted

information processing, making it particularly suited for domains that demand high levels of accuracy and relevance. As a result, LLMs can deliver more useful and applicable content, significantly improving the quality and effectiveness of academic and professional outputs.

Example Prompt:

"Generate three potential article titles on the effects of gamification in education: 1) A scholarly journal-style title 2) A cross-disciplinary title for educators and psychologists 3) A short, engaging title for public communication."

The following were some other examples application of specificity and targeting via some well-known techniques.

Target your response (TAR) Prompting

- You would like to know more about coffee
- Instead of simply asking, "Tell me about coffee."
- Instead: "Provide a 3-sentence summary about the origins of coffee."
- The latter carefully guides towards enhanced contextual bounds of its response

Prompt Macros & End-goal Planning

- You would like the model to help you plan a trip within a single interaction
- Use a macro prompt like "Plan a 5-day trip to Colorado in January."
- Provide an appropriate level of nuance(itinerary, lodging, and activity suggestion)

Contrastive Prompting

- "Compare and contrast Python and Java programming languages."
- Gain insights into their syntax, performance, and use cases
- Help you make informed decisions

4.1.4 Meta-Cognition and Self-Reflection

Meta-cognition and self-reflection are key techniques that delve into the self-analytical capabilities of large language models (LLMs). Here, the AI is not only a generator of content but also a critic of its own output. By prompting for self-reflection, researchers simulate peer review or internal dialogue. These methods foster self-guided learning, enabling the AI to continuously improve its responses by anticipating user needs.

By broadening the scope of LLM applications, these techniques enhance the interactive and assistive capabilities of the AI, making it more adept at providing tailored and insightful support. This self-aware approach improves the accuracy and relevance of information and ensures that the AI can adapt to various contexts and requirements, significantly boosting its utility in academic and professional settings.

Example Prompt:

"Evaluate the weaknesses of the argument you just generated. Suggest two alternative framings that could improve its clarity or originality."

Advanced Insight

Meta-prompting leverages the model's own predictive process which it act as self-regulation. By asking the AI to critique or rate its prior output, you are essentially forcing it to re-run the probability space with a narrower filter. This resembles self-consistency prompting, where multiple candidate outputs are generated and cross-validated. Computationally, repeated sampling increases the probability of converging on a more coherent solution.

The following were some other examples application of meta-cognition and reflection via some well-known techniques.

Self-reflection Prompting

- A model has given a questionable answer on an ethical matter
- You might follow up with, "Are you sure about that?"
- Prompt the model to self-reflection its previous response

- Force closer inspection on initial question and reasoning

Meta-Prompting

- "Analyze the effectiveness of the given prompts & suggest improvements."
- Process of prompting was introduced into the current context
- Provide insights into improving the design of your prompts

Anticipatory Prompting

- "How do I plant tomatoes?"
- Might extrapolate from the context that you are new to growing tomatoes
- Also anticipate potential follow-up concerns (e.g., tips on common pests)

4.1.5 Directional and Feedback Loops

Directional and feedback techniques are crucial in guiding large language models (LLMs) toward specific tasks while refining their responses based on user feedback. Prompting is most effective when used as a feedback loop: AI drafts $\rightarrow$ human critiques $\rightarrow$ AI revises. This mirrors how scholars refine their work.

By incorporating these methods, LLMs can ensure their outputs are aligned with user expectations and needs, fostering a more tailored and effective interaction. This approach balances guided output and the model's autonomy, allowing it to generate relevant, accurate, and contextually appropriate information while remaining adaptable to real-time adjustments and improvements based on user input. This iterative process enhances AI's overall quality and utility in various applications.

Example Prompt 1:

- Initial Prompt: "Write a discussion for my results showing that gamification improves problem-solving speed by 15%." – AI Output: A generic discussion with little connection to prior studies.

- Refinement Prompt: “Revise the discussion by (1) comparing with two prior studies, (2) adding implications for digital education policy, and (3) acknowledging at least one limitation.” – Improved Output: A richer, more contextualized section that aligns with academic standards.

The following were some other examples application of directional and feedback loops via some well-known techniques.

Responsive Feedback Prompting

- Prompting the model with feedback on current states
- “I like the color scheme, but can the design be more minimalistic?”
- Relevant input allows its output to be aligned with the user’s preferences.

Directional Stimulus Prompting

- “Add an element of surprise when the hero meets the princess.”
- Indicate a hint of something unexpected without specific details
- Incorporate unspecified twists and suspend the specifics.

Ambiguous Prompting

- Instead, “Write a story about a knight saving a princess from a dragon.”
- Simply, “Write a story about bravery.”
- Being intentionally vague to reduce context
- Encourage the output uninfluenced by user preferences.

4.1.6 Multimodal and Cross-Disciplinary

Multimodal and cross-disciplinary techniques significantly enhance the versatility and applicability of large language models (LLMs) by integrating various input modes and diverse knowledge domains. Research rarely exists in isolation. LLMs can generate richer, more nuanced responses by combining text, images, audio, and other data types. This integration fosters a deeper and broader understanding of complex topics, allowing the AI to

draw from a wider array of disciplines and perspectives.

Consequently, these techniques cultivate more comprehensive and insightful outputs, making LLMs more effective in addressing multifaceted problems and catering to diverse research and academic needs. Asking the AI to merge insights from sociology and neuroscience, or to produce a table and a narrative simultaneously, leverages its multimodal capabilities. The following were some example application techniques:

Multimodal Prompting

- Upload your photo of a diagram of a research (i.e., framework, flowchart, etc.) and questions in a prompt
- "Describe this diagram by writing a descriptive analysis."
- Utilizes modality (image & texts) for understanding and completing the request

Cross-disciplinary Prompting

- "Explain quantum physics principles using analogies from classical literature."
- Explain one discipline through the lens of another
- Provide nuanced yet accurate interpretation of disparate concepts

Historical & Modular Prompting

- Curious how your great-grandfather might view modern technology
- "Describe the Internet as someone from the 1920s would understand it."
- Specify the historical setting that would better contextualize its response.

4.1.7 Creative and Generative

Creative and generative techniques empower large language models (LLMs) to produce content that is not only informative but also engaging and exploratory. These methods expand the capabilities of LLMs in creative tasks, allowing them to generate original ideas, narratives, and solutions.

Prompts can deliberately induce novelty by requiring analogies, metaphors, or hypothetical scenarios.

By harnessing creativity, LLMs can open new avenues for application across diverse domains such as literature, art, marketing, and innovation. This approach enhances the richness and appeal of the content and demonstrates the potential of LLMs to contribute meaningfully to fields that require imaginative and innovative thinking.

Example Prompt:

"Explain the concept of entropy as if it were a folk tale about a village that forgets its stories."

Pitfall Alert

Over-creativity without constraints is risky and not recommended. When experimenting with high-temperature settings or open-ended prompts, the AI may drift into imaginative but irrelevant content. Solution: Add constraints – e.g., "Ensure the folk tale still correctly illustrates the second law of thermodynamics."

Flipped Interaction Prompting

- Rather than providing details to the model and having it generate suggestions
- User prompts the model to ask them questions to guide their creation
- "Ask me questions individually to guide me in creating a comprehensive business plan."
- The model begins asking the user various aspects of business plan development
- "What's your business's main objective?" or
- "Who is your target audience?" and so forth ...

Constrained Vocabulary Prompting

- Ensure accurate and consistent responses; you might instruct
- "Answer customer queries using only medical terminology & avoid colloquial language."
- Encourages a professional and medically accurate tone,
- Reducing the risk of misunderstandings or misinformation

4.2 Function Prompting

Function prompting is an advanced technique in prompt engineering that involves encapsulating prompts into distinct functions, each representing a specific step or task. This method allows for the modularization of complex processes, breaking them into manageable units. By defining these functions clearly, you can ensure that each part of the process is precisely addressed, facilitating a more organized and systematic approach to problem-solving.

Creating a series of functions to establish a workflow is a powerful way to automate complex processes and solve problems more efficiently. By linking these functions, you can create a seamless sequence that guides the AI through each task stage, ensuring consistency and accuracy. This structured approach enhances the AI's performance and makes it easier to manage and refine individual steps within the workflow. Each function can be independently adjusted and improved without disrupting the overall process, leading to more effective and reliable outcomes.

Understanding the functionality and purpose of each step in the workflow is crucial for optimizing performance and achieving desired results. Function prompting helps clarify the roles and objectives of different stages, allowing for better oversight and control. By clearly grasping how each function contributes to the end goal, you can identify potential bottlenecks or inefficiencies and address them proactively. This level of detail and precision in defining and executing tasks improves the output's quality and enhances the AI's ability to adapt to various challenges and requirements in academic and professional contexts.

Main function body

Function Template

"I am reaching out to you for assistance with a specific function. I understand that you can process information and perform various tasks based on the instructions provided. To help you understand my request more easily, I will use a template to describe the function, input, and instructions on what to do with the input. Please find the details below:

function_name:[Function Name]
input:[Input]
rule:[Instructions on how to process the input]

Please provide the output for this function based on my provided details. Your assistance is greatly appreciated. Thank you!

I will replace the text inside the brackets with the relevant information for the function I want you to perform. This detailed instruction should help you understand my request more efficiently and provide the desired output. The format is function_name(input). If you understand, answer one word with ok."

Other functions

Extract Finding Template

"function_name:[Extract_Finding]
input:['text']
rule:[I want you to act as an academician in computing and games. I will provide you with input forms, including 'text' extracted from an article, and you will read, analyze, and summarize the objective, scope, or findings of the given text, whichever is relevant].
If you understand, answer one word with ok."

Make Paragraph Template

"function_name:[Make_Para]
input:['text']

rule:[Please serve as an academic proofreader and computing expert. I will provide input forms, including 'text,' allowing you to expand into one or more paragraphs. I want you to make them more literary but coherent and logical].
If you understand, answer one word with ok."

Fix English Template

"function_name:[Fix_English]
input:['text']
rule: [Please serve as an English master, spelling corrector, and language enhancer. I will provide you with input forms, including 'text.' I want you to improve the text's vocabulary and sentences with more natural and elegant language but keep the meaning the same].
If you understand, answer one word with ok."

Example Usage:

Single Use

"Extract_Finding('TEXT')"

Nested Use

"Fix_English(Make_Para(Extract_Finding('TEXT')))"

Function prompting introduces a modular style, treating prompts like programmable functions with defined inputs and outputs. This approach is particularly powerful for academic research, where clarity of variables and outcomes is essential. Applied to a vague question like "How do I study student stress?," the function prompt yields structured variables, sampling strategies, and analytical techniques. This bridges the gap between inspiration and operational design.

4.3 Advanced Meta-Prompting

Meta-prompting is an advanced technique in prompt engineering that emphasizes the structural and syntactical aspects of problems rather than

focusing on specific content details. By prioritizing the general format and pattern of prompts, meta-prompting allows for a more abstract and flexible approach to problem-solving.

Meta-prompting teaches the AI how to prompt itself. It is a recursive practice, where the system reflects on, critiques, or improves its own instructions. This method is particularly useful for developing a deep understanding of the underlying frameworks that govern various issues, enabling AI to apply these frameworks across various contexts and scenarios (Figure 4).

- **Self-Critique Loops**: Asking the AI to grade its own answers.
- **Role Switching**: Having it respond as both a novice and an expert, then reconcile differences.
- **Simulated Peer Dialogue**: Prompting the AI to generate debates between opposing viewpoints.

Example Prompt:

"Generate two contrasting interpretations of [theory]. Let Persona A defend it enthusiastically, Persona B critique it skeptically. Then summarize where they agree and what new question emerges from their debate."

This technique fosters dialectical reasoning, allowing the AI to serve as multiple interlocutors in a scholarly discussion. One of meta-prompting's key strengths is its effectiveness in identifying and solving the underlying patterns of problems. Instead of addressing individual content details, meta-prompting helps recognize the broader structures that shape these issues. This approach allows the AI to generate more generalized solutions that can be adapted to different situations, making it a powerful tool for tackling complex and multifaceted challenges. By focusing on the architecture of problems, meta-prompting facilitates the development of robust and versatile problem-solving strategies.

Importantly, meta-prompting is designed to improve the quality and effectiveness of existing prompts rather than directly addressing specific tasks. By refining the format and patterns of prompts, this technique enhances the AI's ability to generate high-quality outputs consistently. It enables a more systematic and coherent approach to prompt creation,

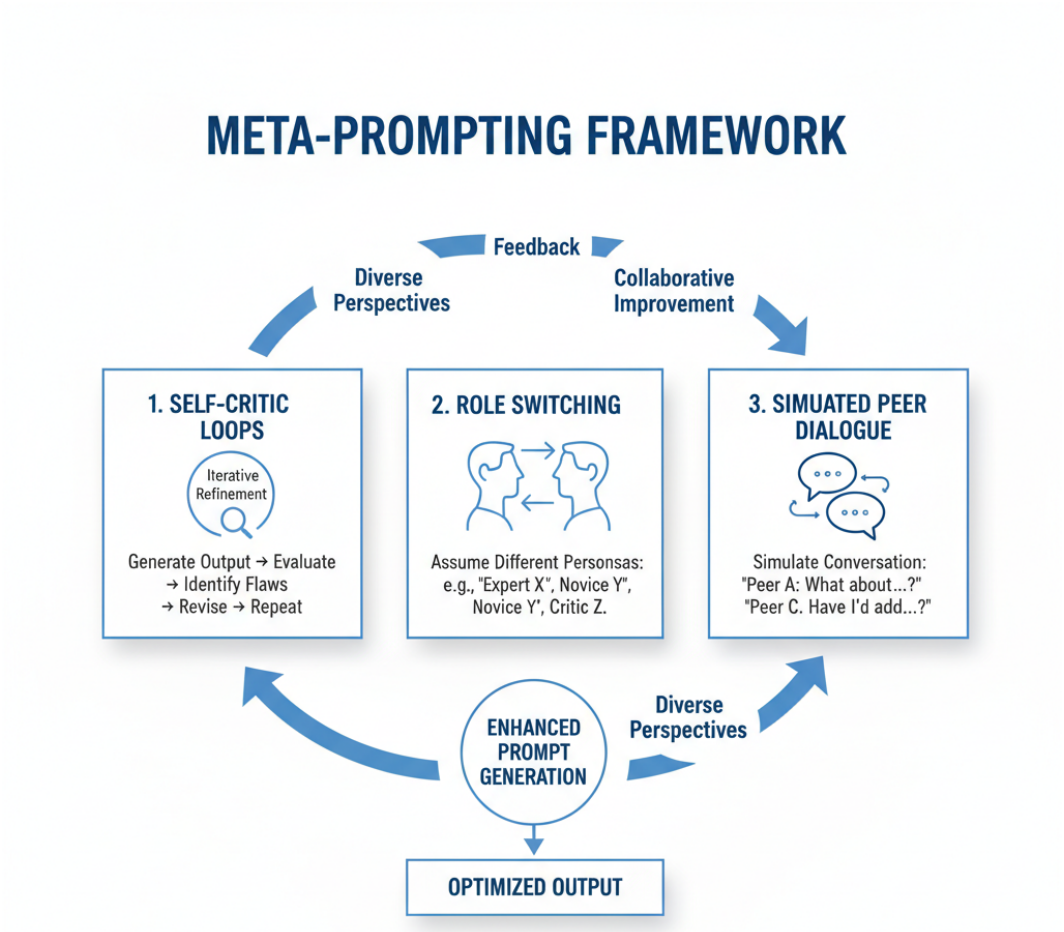


Figure 4: Meta-prompting framework that involves self-critique loops, role switching, and simulated peer dialogue (generated by Gemini).

ensuring the AI can navigate and respond to various problems with greater precision and reliability. In essence, meta-prompting optimizes the foundational aspects of prompt engineering, leading to more efficient and effective interactions with the AI.

Design Better Reasoning Prompt

"Task: Prompt Revision to Enhance Reasoning Capabilities.

1. Input Prompt:[input prompt]
2. Objective: Revise the above input prompt to enhance critical thinking and reasoning capabilities.
3. Key Elements for Revision:
    - Integrate complex problem-solving elements.
    - Embed multi-step reasoning processes.
    - Incorporate scenarios challenging conventional thinking.
4. Expected Outcome:
    - The revised prompt ([revised prompt]) should stimulate deeper analytical thought.
    - It should facilitate a comprehensive understanding of the subject matter.
    - Ensure the revised prompt fosters the exploration of diverse perspectives.
    - The prompt should encourage the synthesis of information from various domains.

If you understand, answer one word with ok."

Design Better Concise Prompt

"Task: Prompt Simplification.

1. Input Prompt:[input prompt]
2. Goal: Transform the original prompt into a more concise version while preserving its essence and objective.
3. Instructions for Transformation:
    - Maintain the primary purpose and objectives of the original prompt.
    - Focus on distilling the prompt to include only key instructions and essential information.

- Eliminate any extraneous or non-essential details.
- Use clear, direct language to ensure ease of understanding.
- Where beneficial, employ bullet points to structure and enhance clarity.

4. Expected Outcome: The [revised prompt] should be succinct yet sufficiently detailed to guide effective task completion. It should be structured for ease of comprehension and application, ensuring a focused and streamlined approach to the task.

If you understand, answer one word with ok."

Design Recursive In-Context Prompt

"Task: Meta Prompting for In-Context Prompt Design.

1. Document Analysis:-
   Input: [Complex document, e.g., research paper, or even including this prompt itself]
   Action: Analyze and comprehend key concepts, methodologies, challenges, and objectives.
2. Task Interpretation:-
   Action: Synthesize information to define the core problem or task.
   Considerations: Identify constraints, goals, or requirements.
3. Prompt Design:-
   Objective: Develop a structured prompt for problem-solving.
   Elements: Instructions, step-by-step approach, background information.
4. Optional-Direct Solution Proposal:-
   Objective: Propose initial steps or a complete solution strategy.
   Considerations: Feasibility and practicality within the context.
5. Output Prompt: [to be generated using the same format as this prompt]

Note: The output is a coherent, actionable prompt/solution strategy tailored to the specifics of the input document. If you understand, answer one word with ok."

4.4 Templates for Writing Critical Body of Text

4.4.1 Research Discussion Template

"Evaluate the significance of the study's findings and their implications for advancing the understanding of [research topic]."

"Analyze the contributions of the current study to the existing body of knowledge on [research topic] and highlight areas for future research."

"Discuss how the study findings align with or challenge existing theories and models in the [research topic] field."

"Reflect on the methodological choices made in the study and assess their strengths and limitations concerning the research objectives of [research topic]."

"Compare the results of the current study with the previous research in the literature on [research topic], highlighting similarities, differences, and potential reasons for discrepancies."

"Discuss any unexpected or contradictory findings and propose potential explanations or avenues for further investigation on the [research topic]."

"Examine the practical implications of the study's findings and discuss how they can inform decision-making or practice in [research topic]."

"Consider the generalizability of the study's findings to other contexts or populations and discuss the potential impact on broader knowledge in [research topic]."

"Discuss the ethical considerations involved in conducting the study and their implications for the interpretation and generalizability of the findings on [research topic]."

"Summarize the study's key findings, emphasizing their relevance, limitations, and implications for future research and practice in [research topic]."

4.4.2 Research Conclusion Template

"Synthesize the findings from different research sources to draw meaningful conclusions about [research topic]."

"Reflect on the significance of the study's findings on [research topic] in addressing the research gap identified in the literature."

"Discuss the potential impact of the study's findings on practical solutions or interventions in [research topic]."

"Address any limitations or constraints encountered during the study on [research topic] and their implications for the research outcome."

"Highlight the implications of the study's findings on [research topic] for future research directions and potential areas for exploration."

"Reflect on the methodology employed in the study on [research topic] and its strengths in generating reliable and valid results."

"Discuss the relevance of the study's findings in the context of current theories or frameworks in [research topic]."

"Summarize the key arguments and findings of the study in [research topic], highlighting their coherence and supporting evidence."

"Discuss any unexpected findings that emerged during the research process and their implications for understanding [research topic]."

"Reflect on the practical implications of the study's findings for professionals or practitioners in [research topic]."

4.4.3 Research Summarization Template

"Act like an experienced academic summarizer. You have been summarizing academic papers for 20 years, specializing in literature reviews.
Objective: Summarize the key findings of the provided academic paper in a comprehensive paragraph. Include the main argument, methodology, and conclusions.
Take a deep breath and work on this problem step-by-step."

"Act like an expert academic writer. You have 15 years of experience condensing complex academic articles into summaries for scholarly journals.
Objective: Create a concise summary of the provided text, focusing on the introduction, key points discussed, and the conclusion. Ensure the summary is suitable for an academic audience.
Take a deep breath and work on this problem step-by-step."

"Act like a professional researcher and academic editor. You have extensive experience summarizing long research papers into brief abstracts for academic databases.
Objective: Summarize the provided research article into an abstract of no more than 200 words. Highlight the purpose, methods, results, and significance of the study.
Take a deep breath and work on this problem step-by-step."

"Act like an academic advisor specializing in summarizing thesis documents. You have helped numerous students distill their lengthy theses into concise summaries.
Objective: Summarize the given thesis into a one-page executive summary. Focus on the research question, methodology, results, and implications.
Take a deep breath and work on this problem step-by-step."

"Act like a seasoned academic summarizer for scientific articles. You have a background in condensing complex scientific studies for broader audiences.
Objective: Summarize the provided scientific paper into a layman's summary of 150 words. Include the problem statement, main findings, and the significance of the research.
Take a deep breath and work on this problem step-by-step."

"Act like an academic journal editor focusing on summarizing research findings. You have a decade of experience in creating concise article summaries.
Objective: Summarize the article, focusing on the hypothesis, research methods, key results, and conclusions. Ensure the summary is accurate and clear.
Take a deep breath and work on this problem step-by-step."

"Act like an experienced scientific summarizer. You specialize in summarizing complex engineering research papers for academic publications.
Objective: Summarize the key points of the provided engineering research paper. Focus on the research objectives, methodology, results, and significance.
Take a deep breath and work on this problem step-by-step."

"Act like a veteran academic summarizer with a background in social sciences. You have been condensing sociological studies into summaries for academic reviews.
Objective: Summarize the main findings and implications of the provided sociological study in a concise paragraph. Highlight the key themes, methodology, and conclusions.
Take a deep breath and work on this problem step-by-step."

"Act like a skilled academic summarizer for legal studies. You have a decade of experience distilling complex legal research articles into succinct summaries.
Objective: Summarize the provided legal research article into a summary suitable for an academic audience. Focus on the legal issue addressed, methodology, key findings, and conclusions.
Take a deep breath and work on this problem step-by-step."

4.4.4 General Summarization Template

"Act like an experienced academic summarizer. You have 20 years of experience summarizing research findings for executive summaries.
Objective: Summarize the provided paragraph into a concise abstract, highlighting the main findings and their implications for policy-making.
Take a deep breath and work on this problem step-by-step."

"Act like a seasoned academic writer focusing on summarizing scientific research. You have extensive experience in distilling complex findings into actionable insights.
Objective: Create a summary of the given paragraph that captures the key results and suggests potential applications in the industry.
Take a deep breath and work on this problem step-by-step."

"Act like an expert academic editor specializing in summarizing lengthy research articles. You have helped numerous researchers condense their work into brief abstracts for grant applications.
Objective: Summarize the provided text into a brief abstract, emphasizing the study's purpose, methodology, and key results.
Take a deep breath and work on this problem step-by-step."

"Act like an academic advisor with expertise in summarizing doctoral theses. You have guided many students in creating concise summaries of their research findings.
Objective: Summarize the given paragraph into an executive summary, focusing on the research question, significant findings, and recommendations for further research.
Take a deep breath and work on this problem step-by-step."

"Act like a professional academic writer with a background in humanities. You have been summarizing historical research articles for academic journals for 20 years.
Objective: Summarize the paragraph into a concise summary highlighting the historical context, main arguments, and key conclusions.
Take a deep breath and work on this problem step-by-step."

"Act like an experienced scientific summarizer. You specialize in summarizing complex engineering research papers for academic publications.
Objective: Create a concise summary of the provided paragraph, focusing on the engineering problem addressed, methodology, and key findings.
Take a deep breath and work on this problem step-by-step."

"Act like a veteran academic summarizer with a background in social sciences. You have been condensing sociological studies into summaries for academic reviews.
Objective: Summarize the main findings of the provided paragraph into a concise summary, highlighting key themes, methodology, and implications for policy.
Take a deep breath and work on this problem step-by-step."

"Act like a skilled academic summarizer for legal studies. You have a decade of experience distilling complex legal research articles into succinct summaries.
Objective: Summarize the given paragraph into a summary suitable for an academic audience. Focus on the legal issue addressed, key findings, and potential impact on legal practices.
Take a deep breath and work on this problem step-by-step."

"Act like an expert in academic summarization focusing on business research. You have extensive experience summarizing business case studies and reports for executive decision-making.
Objective: Summarize the provided paragraph into a concise abstract, emphasizing the business challenges, key findings, and strategic recommendations.
Take a deep breath and work on this problem step-by-step."

"Act like an academic summarizer specializing in medical research. You have summarized clinical studies and trials for medical journals for 15 years.
Objective: Create a concise summary of the provided paragraph, highlighting the clinical question, methodology, key results, and implications for patient care.
Take a deep breath and work on this problem step-by-step."

4.5 Chapter Summary

Advanced prompt engineering is not simply about clever phrasing but about cultivating a reflective, interactive workflow between human and machine. By chaining prompts, employing meta-prompting, and synthesizing across domains, researchers can extend both the depth and originality of their work. Yet the power of these techniques requires balance: creativity must be constrained, and intellectual autonomy must be preserved.

Prompt engineering at this level is best understood as co-thinking: an evolving partnership where human judgment and AI's generative ability reinforce one another.

5 Ethical Consideration and Limitations

The integration of Large Language Models (LLMs) into academic research and writing introduces profound opportunities but also raises pressing ethical concerns and technical limitations. While these models can accelerate productivity, streamline drafting, and enhance accessibility, their use must be balanced against risks of academic misconduct, misinformation, data insecurity, and a gradual erosion of original scholarly voice. This section examines these issues across several critical dimensions.

5.1 Academic Integrity and Misuse

One of the foremost ethical challenges is the potential for academic dishonesty. Students and researchers may be tempted to delegate entire writing tasks to LLMs, effectively bypassing the process of learning, critical reflection, and idea development. Such practices compromise the educational mission, which emphasizes cultivating independent reasoning and communication skills. Universities and publishers increasingly stress transparency: for instance, the Committee on Publication Ethics (COPE)[1] requires authors to disclose when and how AI tools were employed, underscoring that final accountability rests with the human author. Failing to provide attribution risks plagiarism, even if the AI-generated text is "novel" in form.

Pitfall Alert

Submitting AI-generated paragraphs without acknowledgment constitutes plagiarism, regardless of whether the content is technically "original."

5.2 Misinformation and Hallucinations

LLMs are capable of generating persuasive yet factually inaccurate content, a phenomenon commonly referred to as "hallucination." This includes fabricated references, misrepresented data, or misleading interpretations. If

[1] https://publicationethics.org/

uncritically accepted, such content can infiltrate scholarly discourse, diminishing the reliability of academic publications and potentially influencing public policy or clinical practice in harmful ways. Responsible use requires rigorous verification through cross-referencing, replication of cited claims, and independent validation of AI-generated material.

Try-It-Yourself

Paste an AI-generated citation into a bibliographic database (e.g., CrossRef) and verify whether the reference exists. Many "convincing" references will not.

5.3 Stifling of Original Thinking

Another subtle limitation arises when scholars over-rely on LLMs for ideation and phrasing. Academic writing is not merely the assembly of text but an intellectual practice of developing arguments, constructing theory, and advancing knowledge. If AI becomes the primary architect of scholarly prose, there is a risk of homogenization, where innovative voices and unconventional perspectives are muted. Moreover, novice researchers may miss the transformative experience of grappling with uncertainty, structuring arguments, and cultivating an academic identity.

Reflection Point

Consider how you can use AI as a partner in refining ideas without outsourcing the very act of generating them.

5.4 Security, Privacy, and Data Protection

Beyond textual risks, LLMs introduce significant security concerns. Three interrelated domains are particularly critical:

- Data Security: Sensitive research information, especially unpublished data or confidential participant records, may be exposed when entered into third-party LLM platforms. Risks include adversarial attacks, data exfiltration, or "prompt injection" attacks designed to elicit protected information.

- Model Security: LLMs themselves may be exploited through tampering or training data poisoning, undermining the integrity of their outputs.
- Infrastructure Security: Cloud-hosted deployment environments are susceptible to breaches, risking intellectual property theft and reputational damage.

Advanced Insight

Unlike traditional cybersecurity risks, LLMs face domain-specific threats such as training data inversion (where sensitive training data is reconstructed from outputs) and semantic prompt injection (where hidden instructions manipulate model behavior). These demand specialized monitoring and defense mechanisms.

5.5 Governance, Legal, and Regulatory Frameworks

The evolving legal landscape underscores the need for structured governance. The EU AI Act represents a landmark regulatory framework, classifying AI systems according to their risk profile (unacceptable, high, limited, minimal). Academic applications of LLMs will often fall into the "limited" or "high" categories, requiring transparency, oversight, and explicit disclosure of risks. Non-compliance carries significant penalties, tied to institutional accountability.

Journals, universities, and funding agencies increasingly require:

- Explicit disclosure of AI use, including the sections of text generated.
- Documentation of risk assessments, especially for sensitive data.
- Institutional policies that define boundaries of acceptable AI use.

These measures are designed to preserve trust, protect intellectual property, and align academic practice with broader societal expectations of ethical AI deployment.

5.6 Technical and Practical Limitations

In addition to ethical concerns, practical limitations constrain the responsible adoption of LLMs:

1. Opacity (Black Box Problem): The internal reasoning of LLMs remains largely inaccessible to users, raising questions about accountability.
2. Bias Propagation: LLMs can reproduce and amplify stereotypes, suppress minority viewpoints, or reflect citation biases embedded in their training corpora.
3. Resource Costs: Advanced model configurations require substantial computational resources, leading to high monetary costs and environmental burdens due to energy-intensive operations.
4. Language and Cultural Gaps: Despite their global reach, LLMs perform unevenly across languages. For academic purposes, this may privilege English-language outputs and disadvantage scholars working in underrepresented languages.

5.7 Toward Responsible Use: Human–AI Co-Thinking

The path forward requires a paradigm shift from passive reliance on AI to human–AI co-thinking (Figure 5). Rather than delegating complex intellectual tasks, scholars should treat AI as a cognitive partner — one that supports hypothesis generation, structural refinement, and linguistic polishing, while the human author retains the indispensable roles of verifier, evaluator, and innovator.

This approach ensures that AI serves as an amplifier of human creativity, not its replacement. By embedding AI literacy, disclosure practices, and robust governance into academic culture, the research community can harness the benefits of LLMs while safeguarding the integrity of scholarship.

5.8 Potential Strategies to Ensure Factuality

5.8.1 Anchoring Outputs in Verifiable Context

Verifiable context is crucial to ensure the accuracy and relevance of large language models (LLMs)-generated content. This means providing the AI with clear, accurate, and up-to-date information that can be easily cross-referenced with trusted sources. By anchoring the model's outputs in verifiable data, researchers and writers can reduce the risk of disseminating incorrect or misleading information. Including citations and references in

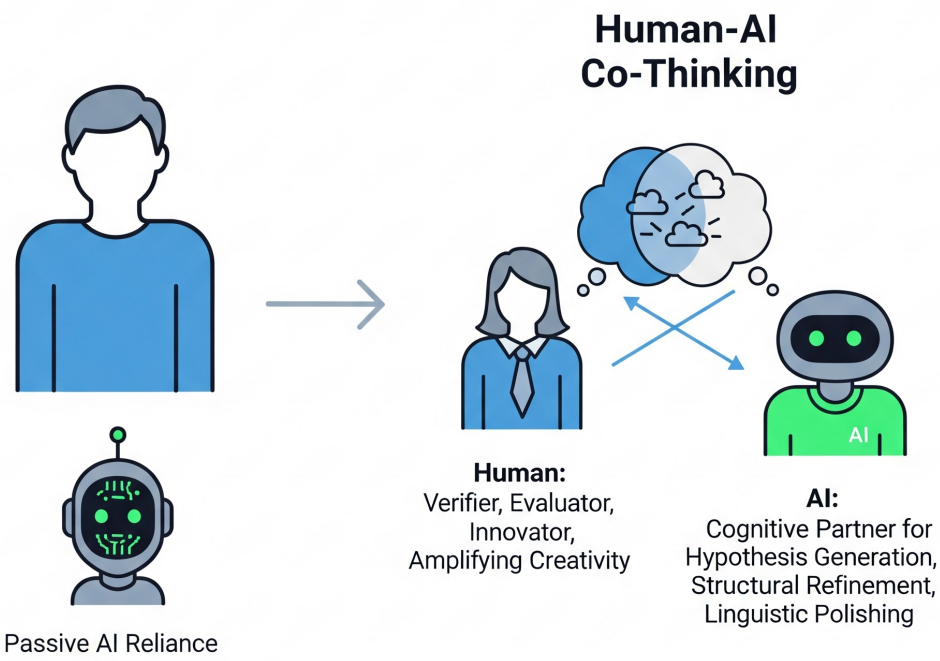


Figure 5: Towards human–AI co-thinking (generated by Gemini)

prompts can guide the model in generating content that is not only coherent but also grounded in established knowledge, thus enhancing the credibility and reliability of the academic work.

5.8.2 Prompt Simplification and Parameter Adjustment

Adjusting model settings for simplicity is another effective strategy to improve accuracy. Simplifying prompts and focusing on clear, specific questions helps the model produce precise and relevant responses. Overly broad or complex prompts often yield ambiguous outputs requiring extensive revision. By fine-tuning the model's parameters (e.g., temperature, maximum token length) to prioritize clarity and directness, users can streamline the writing process and align generated content with their academic objectives.

5.8.3 Inclusion of Diverse Examples

Using varied examples in prompts is essential for promoting accuracy and depth. By exposing the model to a wide range of examples — such as case studies, cross-disciplinary comparisons, and real-world scenarios — users can enhance the model's contextual awareness. This diversity allows the AI to generate richer, more comprehensive responses that reflect multiple perspectives. As a result, outputs become more informative, balanced, and useful for critical scholarly engagement.

5.8.4 Cross-Verification with External Tools

LLM outputs should not be accepted at face value. Researchers can employ fact-checking tools, citation managers (e.g., Zotero, Mendeley), and databases (e.g., CrossRef, PubMed, Scopus) to validate references and data provided by the model. Automated plagiarism detection software can further ensure that AI outputs respect originality and academic integrity.

5.8.5 Iterative Prompting and Refinement Loops

Factuality improves when users adopt an iterative process. This involves generating an initial draft, reviewing the content for errors or gaps, and then refining prompts with additional context or constraints. Iterative refinement — sometimes known as the refinement loop — forces the model to self-correct and align more closely with reliable sources.

5.8.6 Use of Retrieval-Augmented Generation (RAG)

Advanced strategies such as Retrieval-Augmented Generation integrate LLMs with real-time knowledge bases or domain-specific corpora. By retrieving relevant documents from a trusted dataset and using them as grounding context, RAG reduces the risk of hallucination and ensures that the model's outputs are factually consistent with authoritative sources.

5.8.7 Human Oversight and Critical Appraisal

Ultimately, no technical safeguard can replace human judgment. Researchers must exercise critical appraisal of AI-generated content — assessing logic, coherence, and alignment with disciplinary norms. This includes double-checking statistics, re-calculating quantitative results, and evaluating the plausibility of claims. Establishing collaborative writing practices where AI is treated as an assistant rather than a substitute reinforces accountability.

5.8.8 Transparent Documentation of AI Use

Transparency strengthens factuality. By documenting when, where, and how AI tools were employed in the research process, authors provide reviewers and readers with the context needed to assess reliability. This includes specifying which sections were AI-assisted, disclosing prompt structures, and acknowledging the limitations of the generated content.

5.9 Chapter Summary

Factuality in AI-assisted academic writing cannot be taken for granted. While LLMs provide unprecedented support in drafting and ideation, their reliability depends on how responsibly they are guided, verified, and integrated into scholarly practice. By anchoring outputs in verifiable context, simplifying prompts, employing diverse examples, and combining technical safeguards with human oversight, researchers can mitigate the risks of misinformation. Ultimately, ensuring accuracy is not merely a technical adjustment but a scholarly responsibility, but one that reinforces trust, credibility, and the enduring value of academic work.

6 Closing

As we arrive at the conclusion of the Prompt Cookbook, it is worth pausing to reflect on the journey we have taken. From the foundational ideas of what prompts are and how they function, through the stepwise development of academic applications, and finally into advanced frameworks and ethical considerations, this book has sought to equip readers not merely with recipes, but with a way of thinking about prompt engineering as both a craft and a science.

6.1 Prompt Engineering as Intellectual Partnership

Prompt engineering is not about bending machines to our will, but about cultivating a form of human–AI co-thinking. As we saw across the chapters, the most effective prompts are not those that delegate thinking entirely to the model, but those that establish a dialogue where human intent and machine capacity meet. In this sense, prompts are not static inputs but conversational bridges–a form of structured reasoning where the user remains the navigator and verifier.

This shift echoes broader calls in the academic and educational communities to treat AI not as an "autocomplete engine", but as an intellectual partner that augments creativity and rigor, provided we maintain critical oversight.

6.2 A Practical and Theoretical Contribution

By integrating hands-on templates (from titles to methodologies to reviewer responses) with theoretical frameworks such as TELeR's taxonomy of prompts and adaptive reasoning approaches like TREACLE, the book has aimed to balance practice and principle. Our primary audience, academic writers and researchers, should now be able to:

- Approach AI models with deliberate strategies rather than ad hoc trial and error.
- Translate abstract frameworks into tangible outputs (literature reviews, proposals, or results sections).
- Critically evaluate and iteratively refine outputs in a way that strengthens rather than weakens academic rigor.

For technical professionals, we offered glimpses into why structured prompting works (e.g., chain-of-thought, self-reflection, or function prompting), while general readers gained accessible entry points into the language of prompting.

6.3 Ethical Compass for the Future

Throughout the book, we have consistently emphasized that efficiency must not come at the expense of integrity. AI tools can accelerate drafting, revision, and exploration, but they also risk introducing errors, superficial arguments, or even fabricated references. As the Best Practices and Ethical AI Usage documents stress, disclosure, accountability, and intellectual honesty are non-negotiable. The researcher's voice, judgment, and responsibility remain at the center of all scholarly communication.

6.4 Toward a Sustainable Prompting Practice

Looking ahead, prompt engineering is not likely to become less relevant; rather, it will evolve into a fundamental academic literacy, much like information search skills did in the age of digital libraries. Indeed, one might envision a future where mastering prompt strategies becomes as essential for young scholars as mastering citation styles or research design.

But we must also recognize that prompt engineering is more than mechanics: it is a mindset. It is about treating AI not as a shortcut but as a collaborator that can expand our critical, creative, and ethical horizons.

6.5 Final Reflection

The Prompt Cookbook has provided recipes, but it is up to you, the reader, to adapt them to your own intellectual kitchen. No template is final, no framework absolute. The art of prompt engineering lies in iteration, reflection, and adaptation — principles equally central to both good research and good pedagogy.

In the end, the goal is not simply to "get better outputs" from AI. The deeper aim is to nurture a practice of inquiry where humans remain the authors of meaning, while machines serve as catalysts for discovery, clarity, and

dialogue. If this book has helped you move closer to that balance, then it has fulfilled its purpose.

Reflection Point

- How will you integrate the strategies from this book into your daily academic workflow without losing sight of your own intellectual agency?
- What does it mean, for you personally, to “co-think” with AI?

7 Other Supplementary Usage

Finally, navigating the academic publishing process can be complex and challenging, particularly for those new to the field. To assist researchers and academicians in this journey, we provide a collection of example templates designed to streamline key aspects of the submission and review process. These templates are practical guides for crafting essential documents such as cover letters and responses to reviewers' comments, critical components of successful manuscript submissions.

Cover letters play a pivotal role in presenting your research to journal editors, highlighting the significance of your study, and explaining why it is a good fit for their publication. A well-crafted cover letter can make a strong first impression, setting the stage for a positive review process. Our templates offer clear, concise formats and language that can be customized to align with your specific research and the requirements of different journals, ensuring that you effectively communicate the value and relevance of your work.

Addressing reviewers' comments is another crucial step in the publication process. Constructive feedback from peer reviewers can significantly enhance the quality of your manuscript, but responding to these comments requires careful consideration and diplomacy. Our example templates provide structured approaches to addressing reviewer feedback, demonstrating how to acknowledge suggestions, clarify misunderstandings, and make necessary revisions. Using these templates facilitates a more efficient and respectful dialogue with reviewers, ultimately increasing the likelihood of your manuscript's acceptance.

Incorporating these example templates into your academic writing toolkit can greatly enhance your efficiency and effectiveness in navigating the publication process. By following proven formats and strategies, you can focus more on the substance of your research, confident that your submissions and communications are professionally presented and well-received.

7.1 Assistance in Crafting Cover Letters

Initial Cover Letter Template

"You are an academic writing expert tasked with drafting a cover letter to a top-tier journal editor for a new article submission. Your goal is to convey professionalism and expertise in a moderate complexity format. In your response, include an introduction stating the purpose of the submission, a brief overview of the article's significance and contribution to the field, a mention of the target journal and why it's a suitable fit, highlight key findings or innovations of the article, mention any potential reviewers or conflicts of interest, express gratitude for the editor's consideration, closing remarks indicating readiness for any further information or revisions."

Follow-Up Cover Letter Template

"I will provide [TITLE/CONTEXT/FOCUS/ABSTRACT/CONTENT] from my article. Please update the letter to match it. Here's the [TITLE/CONTEXT/FOCUS/ABSTRACT/CONTENT]."

Scope Update of Cover Letter Template

"I will provide the scope/focus of the target publishing venue for my article. Please update the letter to match it. [TITLE/CONTEXT/FOCUS/ABSTRACT/CONTENT]."

7.2 Assistance in Addressing Reviewer's Comments

Response to Reviewer Template 1

"I am currently addressing the revision notes from my article revision. The reviewer is asking me to collect more data and make new plots, but it takes up a lot of time, and it is not possible to conduct more data collection. Can you give me some tips for how to tell the reviewer politely (with some examples) that his suggestions are not possible and convince the reviewer to accept the current one?"

Response to Reviewer Template 2

"I am currently addressing the revision notes from my article revision. I made a mistake in some parts of the text, and the reviewer is asking me to reevaluate the whole study. Can you give me some tips for answering the reviewer politely (with some examples) that the mistake was unintentional and a minor misunderstanding?"

Response to Reviewer Template 3

"I am currently addressing the revision notes from my article revision. [ISSUES]. Can you give me some tips on politely answering the reviewer (with some examples) and [SOME ADDITIONAL ISSUES]?"

Response to Reviewer Template 4

"Act like an experienced academic author and reviewer. You have published and reviewed articles in high-impact journals for 20 years, particularly in [SPECIFIC FIELDS].
Objective: Respond to the reviewer's comment regarding the clarity of your research methodology. Detail the steps taken, clarify any ambiguities, and justify your methodological choices based on the attached [TEXT/DOCUMENT].
Reviewer Comment: 'The methodology section is unclear and lacks sufficient data collection process details.'
Take a deep breath and work on this problem step-by-step."

Response to Reviewer Template 5

"Act like a seasoned academic editor. You have a decade of experience addressing critical and challenging reviews for high-impact factor journals, particularly in [SPECIFIC FIELDS].
Objective: Address the reviewer's concern about the robustness of your statistical analysis as given in the attached [TEXT/DOCUMENT]. Provide a detailed explanation of the statistical techniques used, justify their appropriateness, and include any additional analyses if required.
Reviewer Comment: 'The statistical analysis appears insufficient to

support the conclusions drawn. Please provide more robust statistical validation.' Take a deep breath and work on this problem step-by-step."

Response to Reviewer Template 6

"Act like an expert academic advisor. You have extensive experience revising and improving manuscripts based on reviewers' feedback in high-impact journals, particularly in [SPECIFIC FIELDS].
Objective: Respond to the reviewer's comment on interpreting your findings as given in the attached [TEXT/DOCUMENT]. Clarify your interpretations, provide additional context or data if necessary, and discuss the broader implications of your results.
Reviewer Comment: 'The interpretation of the findings seems overly optimistic and lacks consideration of potential confounding factors.'
Take a deep breath and work on this problem step-by-step."

Response to Reviewer Template 7

"Act like a professional academic writer with a strong background in scientific publishing, particularly in [SPECIFIC FIELDS]. You have successfully revised numerous manuscripts to address comprehensive reviewer comments.
Objective: Address the reviewer's feedback regarding the literature review section as given in the attached [TEXT/DOCUMENT]. Include any overlooked references, expand the discussion on key related studies, and ensure the literature review is comprehensive and up-to-date.
Reviewer Comment: 'The literature review is not comprehensive and misses several key studies relevant to the research topic.'
Take a deep breath and work on this problem step-by-step."

Response to Reviewer Template 8

"Act like an experienced researcher and journal reviewer. You have been involved in the peer-review process for high-impact journals for 15 years.
Objective: Respond to the reviewer's comment on the manuscript's overall contribution to the field. Highlight the novel aspects of your

research, its significance, and how it advances the current knowledge.
Reviewer Comment: ‘The manuscript’s contribution to the field is not clearly articulated. Please clarify the novelty and significance of your work.’
Take a deep breath and work on this problem step-by-step.”

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(online)