



# NATIONAL INSTITUTE ON ARTIFICIAL INTELLIGENCE IN SOCIETY

<http://csus.edu/ai>



## Cognitive Spillover Effects of Prompting

### 1. Meta-Cognitive Development

#### Pattern Recognition and Structural Understanding

- Developing mental schemas for recognizing organizational patterns across different types of content
- Building awareness of how knowledge is structured within specific disciplines
- Learning to identify common frameworks and methodological approaches in various fields

#### Strategic Thinking

- Understanding how to break down complex problems into manageable components
- Learning to identify key variables and relationships in problem-solving scenarios
- Developing the ability to anticipate potential outcomes and implications

### 2. Discipline-Specific Knowledge Architecture

#### Research and Academic Writing

- Absorbing academic writing conventions through exposure to AI-generated responses
- Learning to recognize the structure of academic arguments
- Understanding how evidence is marshaled to support claims
- Developing awareness of citation practices and scholarly discourse patterns

#### Scientific and Technical Fields

- Building mental models of technical processes and systems
- Understanding cause-and-effect relationships in complex systems
- Learning to identify variables and control factors in experimental design
- Developing awareness of technical terminology and its precise usage

#### Creative and Artistic Disciplines

- Understanding principles of composition and design through AI-generated examples
- Learning to recognize effective narrative structures and storytelling techniques
- Developing awareness of stylistic elements and their impact
- Building understanding of genre conventions and creative constraints

### 3. Analytical Skill Development

#### Critical Analysis

- Learning to identify gaps in logic or missing information
- Developing the ability to evaluate the quality of sources and evidence
- Understanding how to assess the strength of arguments
- Building skills in comparing and contrasting different perspectives

#### Data Interpretation

- Learning to recognize patterns in quantitative and qualitative data
- Understanding how to connect data points to broader conclusions
- Developing awareness of statistical concepts and their applications
- Building skills in identifying meaningful trends and outliers

### 4. Professional and Practical Skills

#### Communication

- Learning effective ways to structure information for different audiences
- Understanding how to adapt tone and style for different contexts
- Developing awareness of professional communication conventions

- Building skills in clear and concise expression

### Project Management

- Understanding how to break down complex projects into manageable tasks
- Learning to identify dependencies and sequential relationships
- Developing awareness of resource allocation and timing considerations
- Building skills in strategic planning and organization

## 5. Ethical and Contextual Understanding

### Ethical Reasoning

- Developing awareness of ethical implications in different contexts
- Learning to identify potential consequences of decisions
- Understanding how to balance competing interests and values
- Building skills in ethical analysis and decision-making

### Contextual Awareness

- Learning to recognize how context affects interpretation
- Understanding how different disciplines approach similar problems
- Developing awareness of cultural and historical influences
- Building skills in cross-disciplinary thinking

## 6. Innovation and Problem-Solving

### Creative Problem-Solving

- Learning to generate multiple approaches to challenges
- Understanding how to combine different concepts and ideas
- Developing awareness of innovative solutions in different fields
- Building skills in adaptive thinking and flexibility

### Interdisciplinary Integration

- Learning to connect concepts across different domains
- Understanding how different disciplines can inform each other
- Developing awareness of cross-disciplinary applications
- Building skills in synthesizing diverse knowledge sources

## 7. Future Learning Capacity

### Learning How to Learn

- Developing metacognitive strategies for knowledge acquisition
- Understanding personal learning patterns and preferences
- Building awareness of effective study and practice techniques
- Learning to identify knowledge gaps and areas for improvement

### Adaptability

- Developing flexibility in approach to new concepts
- Understanding how to transfer knowledge between contexts
- Building resilience in face of learning challenges
- Learning to navigate ambiguity and uncertainty

These cognitive spillover effects demonstrate how engaging with AI through prompting can enhance learning and skill development across multiple dimensions, even when the AI is performing much of the initial work. The process of crafting prompts, interpreting responses, and applying insights builds valuable cognitive frameworks that support broader learning and development.

## Examples

AI Use Case	Sample Prompts	Learning Outcomes from Using AI
<b>Text Summarization</b>	"Summarize the main points of [specified topic] in 200 words."	Develops the ability to grasp the big picture and identify essential themes. Promotes critical thinking by requiring users to seek clarifications for gaps or missing context.
<b>Creative Writing Assistance</b>	"Write the beginning of a short story about a world where AI controls all forms of communication."	Teaches pattern recognition in narrative structure and dialogue. Helps users identify elements of storytelling, such as pacing, tone, and character development, while also sparking new ideas and creativity.
<b>Research Assistance</b>	"Provide a literature review on the impact of AI in education over the last five years."	Encourages the ability to evaluate sources and detect patterns in research findings. Promotes understanding of academic language and the structure of literature reviews, even if the AI does the initial heavy lifting.
<b>Coding and Debugging</b>	"Find the error in this code snippet and explain how to fix it."	Helps build pattern recognition for common errors and logical structures in coding, improving students' ability to spot potential issues in their own code.
<b>Scientific Analysis</b>	"Explain the significance of CRISPR in genetic research and its ethical implications."	Promotes understanding of key scientific concepts and ethical issues. It teaches users how to evaluate complex scientific information, fostering critical thinking about the societal impacts of scientific advances.
<b>Essay Structuring</b>	"Outline a five-paragraph essay on the pros and cons of AI in healthcare."	Teaches recognition of patterns in essay structures. By viewing multiple outlines, students learn organizational strategies, even if they don't produce the outline themselves.
<b>Data Interpretation</b>	"Interpret this dataset on climate change indicators and summarize the key findings."	Develops the ability to discern meaningful patterns in data and encourages critical thinking in interpreting statistical outcomes. Even when AI summarizes, users learn how data points relate to broader trends.
<b>Language Translation</b>	"Translate this text from French to English, maintaining the original tone and nuance."	Builds awareness of linguistic and cultural nuances. Even if AI performs the translation, users learn how different languages structure ideas and how tone can shift between languages.
<b>Critical Thinking and Debate</b>	"Present arguments for and against the use of AI in decision-making processes in the criminal justice system."	Encourages recognition of logical patterns in argumentation. Users learn to assess the strength of various arguments and develop an understanding of how evidence is marshaled to support differing views.
<b>Creative Collaboration</b>	"Brainstorm 10 new product ideas that integrate AI and sustainable technologies."	Teaches brainstorming techniques and idea generation patterns. By analyzing AI-generated ideas, users learn how to refine and combine ideas, fostering innovation and interdisciplinary thinking.
<b>Historical Analysis</b>	"Compare and contrast the leadership styles of Winston Churchill and Franklin D. Roosevelt during World War II."	Promotes recognition of patterns in leadership traits and decision-making. Even if AI generates the comparison, users learn how to critically assess similarities and differences in historical contexts and leadership approaches.

AI Use Case	Sample Prompts	Learning Outcomes from Using AI
<b>Ethical Scenario Exploration</b>	"Create a hypothetical scenario where AI causes unintended harm in medical diagnosis, and discuss the potential ethical issues."	Teaches ethical reasoning and scenario analysis. Users gain exposure to thinking through the consequences of technological decisions, learning to identify potential risks and moral implications even if AI generates the initial scenario.
<b>Customized Learning Paths</b>	"Design a personalized study plan for mastering algebra concepts over the next month."	Teaches strategic planning and goal setting. Even if AI provides the study plan, students learn how to break down complex tasks into manageable steps and set learning objectives.
<b>Writing Feedback and Editing</b>	"Provide feedback on this essay, focusing on the clarity of arguments and grammar improvements."	Teaches self-assessment by exposing users to common issues in writing. Analyzing AI-generated feedback helps users recognize patterns of strong or weak argumentation and common grammatical errors.
<b>Artistic Design and AI Tools</b>	"Generate a visual concept for a website layout that integrates minimalism and eco-friendly design elements."	Teaches design thinking by exposing users to visual patterns and design elements. Even if AI creates the visual, users learn to critically assess aesthetic and functional design principles.