WEEK 9-10 Prompt Engineering: From Usage to Mastery

12/16/2025

3RD GRADE IT STUDENTS – IT DEPARTMENT

LECTURER: MOHAMMAD SALIM AL-OTHMAN

Why This Final Week Exists

- You already know how to *use* AI tools.

- The remaining challenge is **using them well**.

- This week focuses on **quality, judgment, and maturity**, not new content.

Example:

Two students use the same AI tool for the same task.

One gets a shallow answer, the other gets a professional result.

The difference is **not the model**, it is **how they prompted it**.
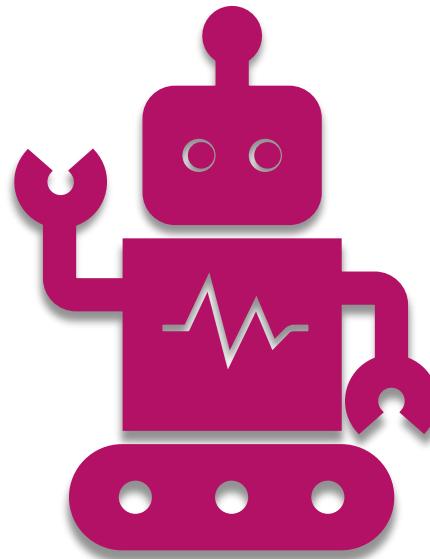
Prompting as Instruction Design

- A prompt is an **instruction**, not a casual question.

- Weak prompts resemble unclear project requirements.

- Strong prompts resemble clear specifications.

- **Example:**

❌ *"Explain Flutter."*

✅ *"Explain Flutter for second-year IT students using simple language and one real-world example."*

Prompt Quality Levels (Not Prompt Types)

- **Low-quality:** vague goal

- **Medium-quality:** clear goal, missing constraints

- **High-quality:** goal + context + constraints + output format

Example:

- Low: *"Summarize this text."*

- Medium: *"Summarize this text for students."*

- High: *"Summarize this text in 5 bullet points for third-year IT students."*
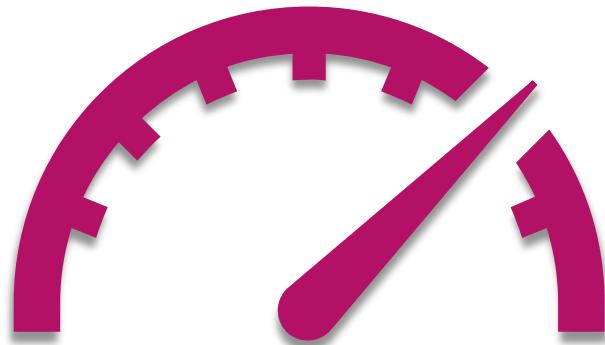
Why Prompts Fail (Failure Analysis)

Most weak AI outputs are caused by **prompt failure**, not AI failure.

Common reasons:

▶ missing context

▶ too many tasks in one prompt

▶ unclear scope

Example:

❌ *"Create a secure login system."*

(Too broad → unclear output)

✅ *"Describe the steps of a secure login system without writing code."*
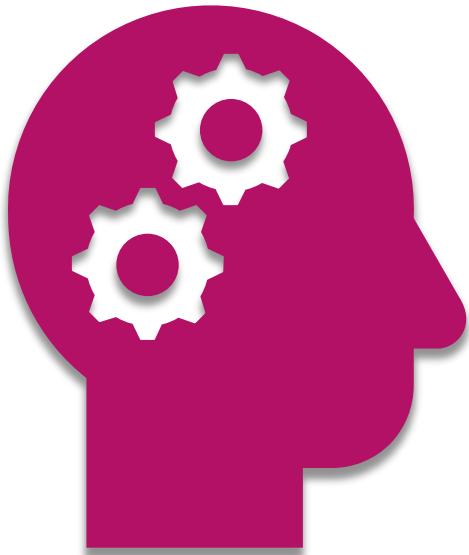
Prompt Iteration Is Intentional, Not Trial-and-Error

Professional prompting follows a **deliberate loop**.

1. Write prompt

2. Review output

3. Identify weakness

4. Refine prompt

Example:

v1: *"Explain AI ethics."* → too generic

v2: *"Explain AI ethics with 3 real-world examples."* → better

v3: *"Explain AI ethics with 3 real-world examples relevant to education."*

Prompt Evaluation: Judge the Prompt, Not the AI

A good prompt should be evaluated by asking:

▶ Is the task clear?

▶ Is the output usable?

▶ Is the scope controlled?

Example:

If the output is **5 pages long** when you needed a **short answer**,

▶ the **prompt failed**, not the **AI Model!**
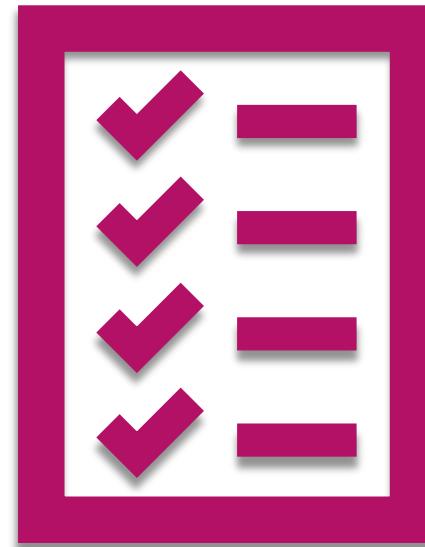
Over-Reliance Is a Prompting Risk
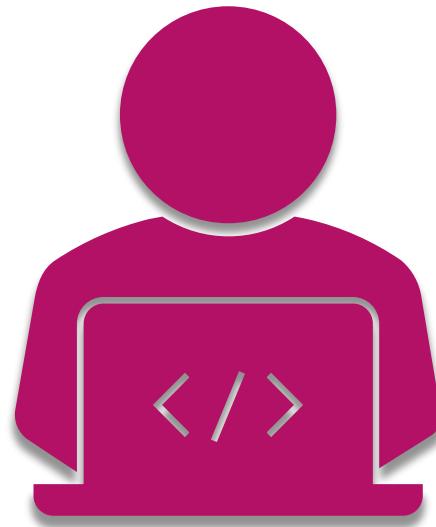
- A strong prompt does **not remove human responsibility**.

Example:

AI generates confident-looking code.

The student submits it without testing.

- The code **fails!**

- The error is **human over-trust**, not AI usage.

Prompting as a Human–AI Collaboration Skill
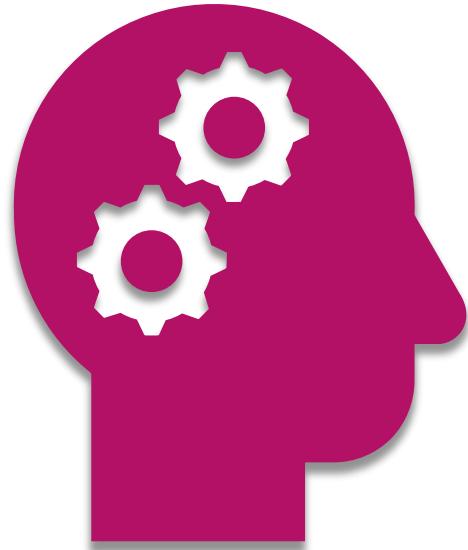
Prompting is collaboration:

▶ human defines goals and constraints

▶ AI generates suggestions

▶ human evaluates and decides

Example:

▶ AI proposes **three** solutions.

▶ The human chooses the most suitable **one** for the context.

What You Should Be Able to Do After This Course

You should be able to:

▶ identify weak prompts

▶ improve prompts systematically

▶ explain why a prompt worked or failed

Example (exam-style):

"Given this prompt, explain two weaknesses and propose an improved version."

AI Prompt Experimentation Tools

- **Examples of prompt experimentation tools:**

- OpenAI GPT Playground (paid)

- Google AI Studio

- Claude
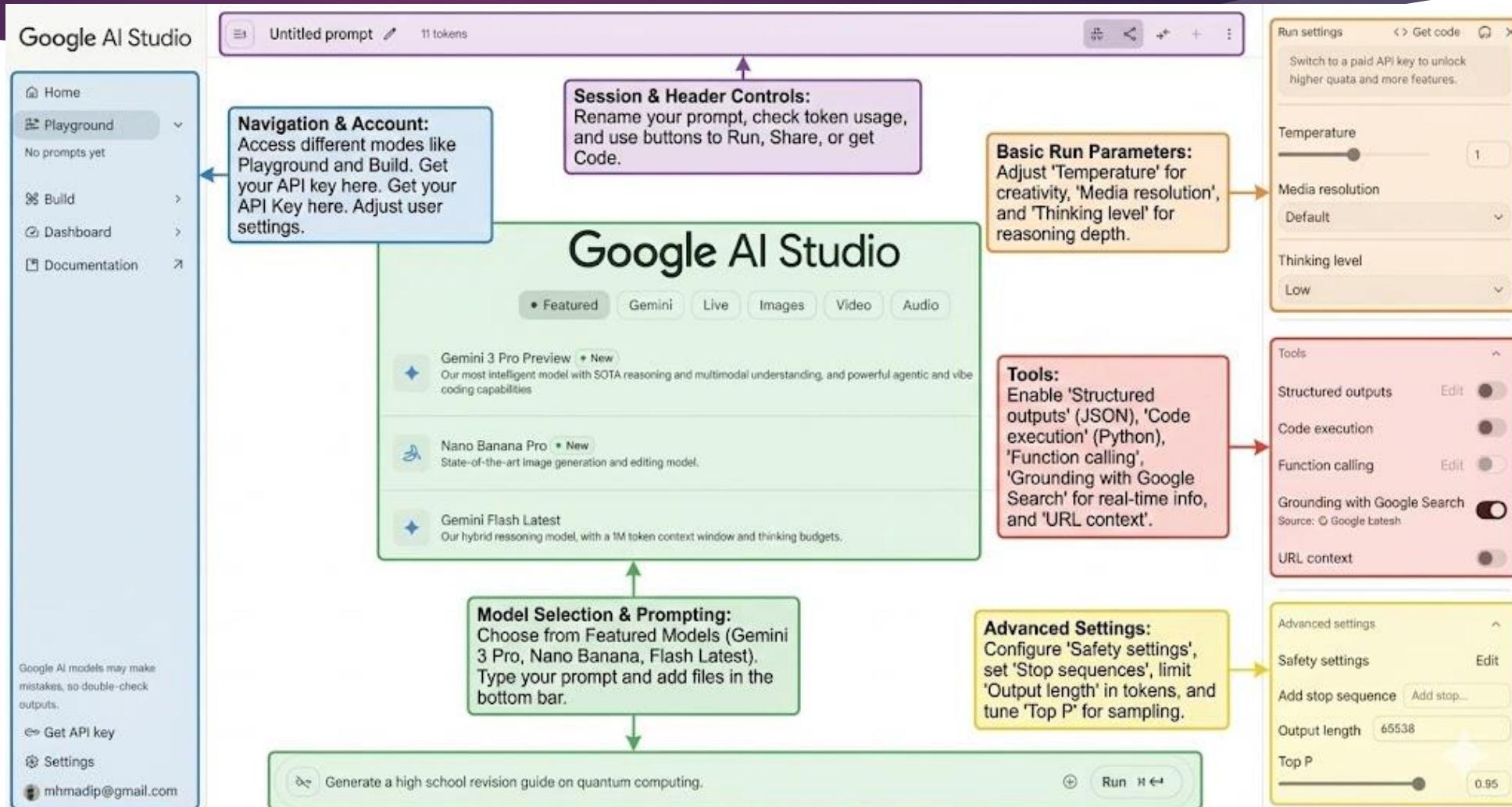
Google AI Studio – Prompts Tools

Google AI Studio: Interface Overview

1. Output & Safety Controls

▶ **Output Length:** Sets the maximum response size (limit tokens) to prevent endless text.

▶ **Safety Settings:** Filters out harmful content like hate speech or harassment.

▶ **Stop Sequence:** Tells the model to strictly stop generating if it hits a specific word/phrase.

2. Advanced Logic & Reasoning

▶ **Thinking Level:** Adjusts how "deeply" the model reasons before answering (Low/High).

▶ **Function Calling:** Enables the model to use external tools or your own APIs.

▶ **URL Context:** Allows you to paste a website link for the model to analyze directly.

3. Developer Workflow Tools

▶ **Token Counter:** Tracks how much "memory" your prompt uses (essential for cost/limits).

▶ **Get Code:** Instantly converts your playground setup into code (Python/cURL) for apps.

▶ **API Key:** The credential needed to connect this model to your own software.

What is a Token?

1. The "Unit of Currency"

▶ **Definition:** A token is the basic unit of text the AI reads and writes. It can be a whole word, part of a word, or even a space/punctuation mark.

▶ **The "Exchange Rate":**

    ▶ **1 Token ≈ 4 Characters** (in English).

    ▶ **100 Tokens ≈ 60–80 Words**.

    ▶ *Example:* The phrase "high school" is 2 tokens.

2. Why It Matters in the App

▶ **Memory (Context Window):** The model has a limit on how much it can "remember" at once (e.g., 1 Million tokens). If your chat history exceeds this, it "forgets" the beginning of the conversation.

▶ **Cost & Speed:** Generating more tokens takes longer and costs more (if you are on a paid plan). The "Output Length" slider limits how many tokens the model *spends* on a single answer.

3. Practical Example

▶ **Your Prompt:** "Generate a high school revision guide..." (11 tokens).

▶ **The Result:** A full 10-page guide might cost ~4,000 tokens.

Asking multiple questions in one prompt reduces token usage because shared context and instructions are transmitted once instead of being repeated across multiple requests.

💰 Token Cost Example: One Prompt vs Many

❌ Many Separate Prompts:

1. You are an IT instructor. Explain simply. What is HTTP?

2. You are an IT instructor. Explain simply. What is HTTPS?

3. You are an IT instructor. Explain simply. What is FTP?

▶ Same context is repeated three times

▶ More tokens and more processing

✅ One Combined Prompt:
You are an IT instructor. Explain simply.
Answer the following:

1. What is HTTP?

2. What is HTTPS?

3. What is FTP?

▶ Context is processed once

▶ Fewer tokens and cleaner output

Important Rule: If the role and context are the same, **combine the questions** to reduce token usage.

Revision Quiz

1. **A prompt should be treated as an instruction or specification rather than a casual question.**

   (True / False)

2. **Weak AI outputs are usually caused by limitations of the AI model rather than problems in the prompt itself.**

   (True / False)

3. **Prompt iteration means deliberately refining the prompt based on output quality, not randomly trying new wording.**

   (True / False)

4. **A strong prompt removes the need for human responsibility because the AI output is reliable.**

   (True / False)

5. **Asking multiple related questions in one prompt can reduce token usage because shared context is processed only once.**

   (True / False)

6. **Google AI Studio is recommended for this course because it allows free prompt experimentation with visible controls such as temperature, output length, and token usage.**

   (True / False)

Bridge to Next Semester
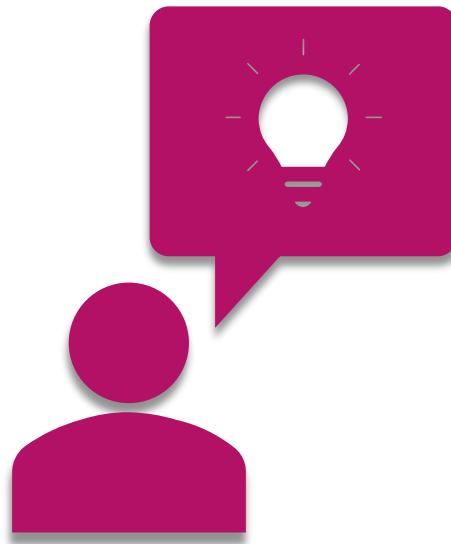
This course focused on:

▶ interacting with AI systems

▶ prompt quality and responsibility

▶ Next semester (Machine Learning) will focus on:

▶ how models learn from data

For Example:
This course: *"How do I ask AI the right question?"*

ML course: *"How does AI learn to answer questions?"*

Recap

Prompt quality reflects thinking quality.

Clear thinking → clear instructions → reliable output

Unclear thinking → vague instructions → weak output

References List

- **https://hai.stanford.edu**

  Human-Centered AI (Stanford). Explains how humans collaborate with AI systems, the role of human judgment, and why responsibility always remains with the user.

- **https://platform.openai.com/docs/guides/prompt-engineering**

  OpenAI Prompt Engineering Guide. Practical principles on prompt clarity, constra

- **https://www.elementsofai.com**

  University of Helsinki – Elements of AI FREE ONLINE COURSES. Student-friendly explanations on using AI wisely, focusing on human responsibility and interaction rather than algorithms.ints, iteration, and why prompts succeed or fail.

- **https://www.technologyreview.com**

  MIT Technology Review. Articles on human-in-the-loop AI, over-reliance risks, and decision support versus automation in real-world systems.