

# The CRAFT Pedagogical Cycle

A five-phase instructional framework for integrated STEM teaching. Print this page for a quick reference.



## C — Contextualize

Activates prior knowledge. Frames *why* this matters through real-world applications, careers, and societal connections.

Open with a real-world problem or scenario. Ask: "Where have you seen this?" Poll or brainstorm to surface what students already know and believe.

## R — Reframe

Surfaces the wrong mental model and installs the correct one. Creates productive cognitive dissonance.

Present a counterexample, demo, or poll result that challenges assumptions. Name the misconception explicitly. Students discuss in small groups.

## A — Assemble

Scaffolded skill-building through I Do → We Do → You Do. This is where the hands-on learning happens.

**I Do** (5 min): Brief facilitator demo.  
**We Do** (10-15 min): Guided practice together. **You Do** (15-25 min): Independent or group application. Aim for 1:5+ talk:do ratio.

## F — Fortify

Verify, test, and stress-test understanding. Errors are features, not failures. Apply the Check the Machine protocol.

Students verify their work against known references using CtM: **Task** (what I asked) → **Before** (what I expected) → **After** (what happened) → **Takeaway** (what I

learned).

## T — Transfer

Connects forward to the next concept, a new context, or the student's own world. Makes learning portable.

Students design, plan, or create something that applies what they learned to *their* context. Share out. Debrief the CRAFT structure itself so students see the pedagogy.

# The Check the Machine (CtM) Protocol

A 4-step verification framework used in the **Fortify** phase. Teaches students to verify AI and computational outputs like engineers.

### 1. Task

What did you ask the AI/tool to do?

### 2. Before

What do you *expect* the answer to be?

### 3. After

What did the AI/tool actually produce?

#### 4. Takeaway

What does the gap reveal?

## Design Principles

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### **Talk:Do Ratio of 1:5+**

For every 1 minute of facilitator talking, participants should be doing for 5+ minutes. If you're talking more than 20% of the time, restructure.

### **Standalone Sessions**

Each session should work independently. Participants who miss one session can still benefit from the others.

### **Light and Fun Tone**

Low-stakes, creative energy. "An experienced colleague explaining to a capable newcomer." Humor welcome.

### **Research-Connected**

Pre/post surveys (anonymous, linked by participant ID) enable data collection without changing the PD experience.

### **Standards-Aligned**

Every activity maps to NGSS, and participants practice the alignment themselves.

- | **Attribution:** The CRAFT pedagogical cycle was developed by Dr. Mike Borowczak and Dr. Andrea C. Borowczak at the University of Central Florida.

# STEM Prompt Library

Tested prompts for AI-assisted STEM teaching. Copy, customize, and iterate. Works across ChatGPT, Claude, and Gemini.

- Pro tip: The best prompts include your **grade level, specific standard, time constraint, and student context**. Generic prompts get generic results.

## Lesson Planning

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Generate a Standards-Aligned Lesson

W1All Platforms

I teach [GRADE] [SUBJECT]. Create a [DURATION]-minute lesson aligned to

[SPECIFIC NGSS STANDARD].

Include:

- A real-world hook that connects to students' lives

- 3 differentiated activities (approaching, on-level, extending)

- One formative assessment check

- Materials list (assume a typical classroom budget)

Format the lesson as: Objective > Hook > Activities > Assessment > Extension

## **Differentiate an Existing Lesson**

### **W1All Platforms**

Here is my existing lesson: [PASTE LESSON]

Differentiate this for three levels:

1. Approaching: Students who need scaffolding with [SPECIFIC SKILL]

2. On-level: Students meeting grade-level expectations

3. Extending: Students ready for deeper challenge

Keep the same core learning objective but adjust complexity, vocabulary, and

support structures.

### **Generate a Week of Inquiry Problems**

W1Best on Claude

Create 5 inquiry-based [SUBJECT] problems for [GRADE] students, one per day.

Requirements:

- Each problem should take 15-20 minutes

- Progress from concrete to abstract across the week

- Include at least one problem that connects to [CAREER/REAL-WORLD CONTEXT]

- Aligned to [NGSS STANDARD]

- Include teacher notes for common misconceptions

## Assessment & Rubrics

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### Create a Rubric from a Standard

W1All Platforms

Create a 4-level rubric (Beginning, Developing, Proficient, Advanced) for this

standard:

[PASTE NGSS PE]

For each level, describe:

- What the student CAN do at this level

- Observable evidence (what you would see/hear)

- Example student work or response

Format as a table.

## Verification & Error Checking

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**Generate a Verify-able Output**

W2All Platforms

Generate a [SUBJECT] explanation of [TOPIC] for [GRADE] students.

IMPORTANT: Intentionally include 2-3 subtle errors that a student should be

able to catch using:

- Their textbook

- A calculator

- Prior knowledge from [PREVIOUS UNIT]

I will use this as a "Check the Machine" classroom activity. Do NOT tell me

where the errors are.

## **Debug AI-Generated Code**

**W2W3**

I asked an AI to write this code: [PASTE CODE]

The code is supposed to: [DESCRIBE INTENDED BEHAVIOR]

But instead it: [DESCRIBE ACTUAL BEHAVIOR]

walk me through the debugging process step by step. Explain what each line

does, identify the error(s), and show the corrected version with comments

explaining the fix.

## Physical Computing & IoT

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**Generate micro:bit Code from Description**

W3Best on Claude

Write MakeCode JavaScript for BBC micro:bit V2 that:

[DESCRIBE WHAT THE PROGRAM SHOULD DO]

Sensors to use: [LIST SENSORS]

Output: [LED display / sound / radio / serial]

Include comments explaining each block. Also provide the equivalent MakeCode

blocks description so I can rebuild it visually.

## Create a Sensor Data Collection Plan

### W3All Platforms

I want my [GRADE] [SUBJECT] students to use BBC micro:bit sensors to

investigate:

[SCIENCE QUESTION]

Design a data collection plan that includes:

- Which sensor(s) to use and why

- How often to collect readings

- How many trials/samples needed

- A data table template

- Potential sources of error and how to control them

- How to connect findings to [NGSS STANDARD]

## **Administrative Time-Savers**

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### **Parent Communication**

#### **W1All Platforms**

Draft a parent newsletter paragraph explaining that our class is starting a

unit on [TOPIC].

Tone: Warm, professional, excited

Length: 150 words max

Include: What students will learn, one way parents can support at home, and a

sentence about how we're using AI tools responsibly in class.

## IEP/504 Accommodation Suggestions

W1Best on Claude

I have a [SUBJECT] lesson on [TOPIC] for [GRADE].

A student has the following accommodation: [DESCRIBE ACCOMMODATION]

Suggest 3 specific ways to modify the lesson activities while maintaining

rigor and access to the same core learning objective. Be practical – suggest

modifications I can implement with the materials I already have.

**Remember:** Always verify AI-generated content before using it with

students. Use the Check the Machine (CtM) protocol: Task → Before → After →

Takeaway.



# Platform Comparison: ChatGPT vs Claude vs Gemini

Side-by-side comparison for STEM educators. Updated April 2026. Your mileage may vary — test all three!

<b>Best For</b>	Code generation, creative writing, broad general knowledge	Long-form analysis, nuanced instruction, safety-aware outputs	Google ecosystem integration, multimodal (images), real-time info
<b>STEM Strengths</b>	Strong at generating code examples, math problem sets, and step-by-step solutions	Excellent at explaining concepts clearly, catching its own errors, and structured lesson design	Good at pulling current data, integrating with Google Workspace, and image analysis
<b>STEM Weaknesses</b>	Can be confidently wrong on calculations; sometimes over-explains	Can be overly cautious; occasionally refuses borderline requests	Math accuracy varies; lesson outputs can be generic
<b>Lesson Planning</b>	★★★★ Good structure, sometimes verbose	★★★★★ Best at standards alignment and	★★★★ Decent but less detailed

		differentiation	
<b>Code Generation</b>	★★★★★ Strongest code generation	★★★★★ Strong, especially for explanation alongside code	★★★ Good for simple scripts
<b>Math Accuracy</b>	★★★★ Verify everything	★★★★ Verify everything	★★★★ Verify everything
<b>Prompt Following</b>	★★★★★ Good at complex multi-part prompts	★★★★★ Best at following detailed instructions precisely	★★★ Sometimes misses parts of complex prompts
<b>Free Tier</b>	GPT-4o limited; GPT-3.5 unlimited	Claude Sonnet limited daily messages	Gemini Pro limited daily
<b>Best Free Option</b>	chat.openai.com	claude.ai	gemini.google.com
<b>School-Friendly?</b>	ChatGPT Edu available for institutions	No specific edu tier yet	Integrated with Google Workspace for Education

## When to Use Which

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Generating a differentiated lesson plan      Claude

Best at following complex formatting requirements and standards alignment

Writing/debugging code for micro:bit	ChatGPT or Claude	Both strong at code; ChatGPT slightly faster, Claude better at explaining
Creating a rubric from an NGSS standard	Claude	Most consistent at structured, detailed outputs
Generating quiz questions quickly	ChatGPT	Fast, creative, good variety
Analyzing student work samples	Claude	Most nuanced feedback; best at maintaining assessment criteria
Pulling current data for a lesson	Gemini	Has access to current Google Search results
Creating visual descriptions for slides	Gemini	Best multimodal capabilities
Translating a lesson to Spanish	Any	All three are strong at translation

- | **Critical reminder:** ALL platforms hallucinate. Math accuracy is unreliable
- | on ALL three. Always verify calculations, citations, and scientific facts before
- | using with students. The platform comparison above reflects general
- | tendencies, not guarantees.

## Quick Access Links

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ChatGPT [chat.openai.com](https://chat.openai.com)

Claude [claude.ai](https://claude.ai)

Gemini [gemini.google.com](https://gemini.google.com)

