

# AI TEACHING & LEARNING SERIES #5: CRITICAL & CREATIVE ENGAGEMENT

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# OUTCOMES

- Apply AI-as-partner frameworks to design active learning experiences that foster critical inquiry.
- Create iterative prompts that require students to challenge, fact-check, and refine AI-generated outputs, shifting the focus from the product to the reasoning process.
- Develop metacognitive reflection questions and assignment instructions that assess the “human loop,” evaluating how students curate, critique, and build upon AI contributions.

# PRODUCTIVE FRICTION



Honing theory (Gabora, 2016)



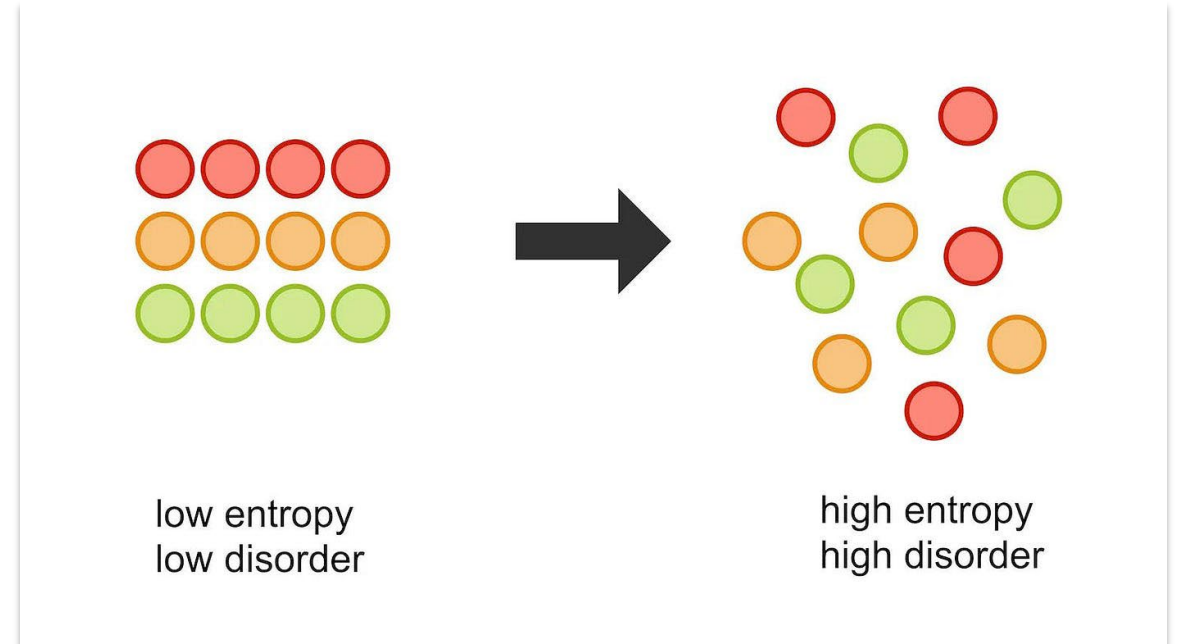
Desirable difficulty (Bjork & Bjork, 2011)



Mini-c creativity (Kauffman & Beghetto, 2009)

# HONING THEORY (GABORA, 2016)

- Minds, modify their knowledge and adapt to their environments to minimize entropy
- Creativity begins when there is uncertainty and we repeatedly consider the new knowledge from different perspectives until existing knowledge base is restructured

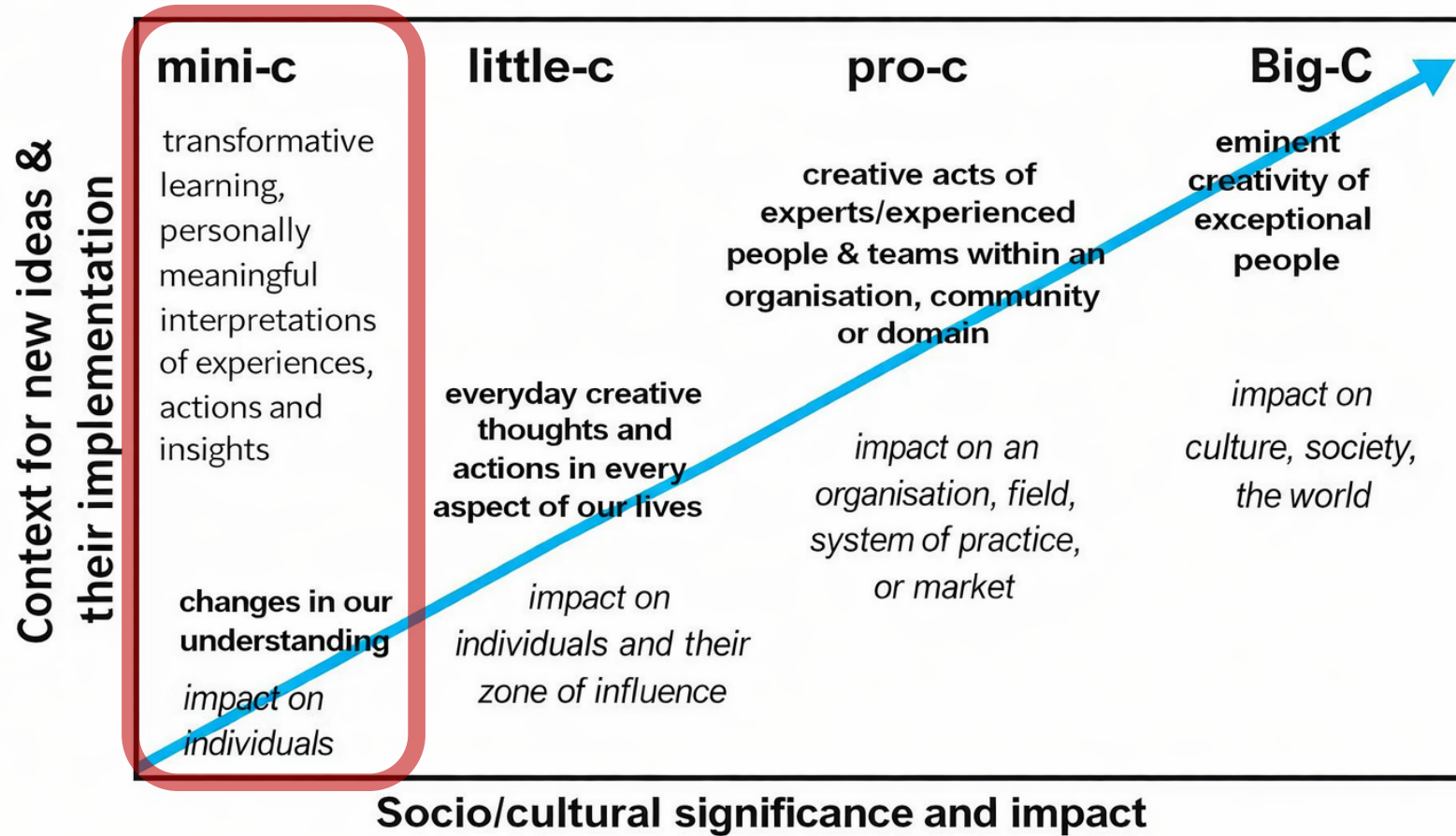


# DESIRABLE DIFFICULTY (BJORK & BJORK, 2011)

- Desirable difficulty is when you making various tasks harder which results in stronger, more durable long-term memory and understanding
- Examples include:
  - Spacing
  - Interleaving
  - Retrieval Practice / Self-teaching
  - Varied practice

# Four-C model of creativity

Kaufman and Beghetto (2009)





Honing theory – **The Mess**



Desirable difficulty – **The Struggle**



Mini-c creativity – **The Meaning**

# OUR AI PARTNERS

1. **Socratic Simulator:** the AI will be used to only provide questions rather than answers. these questions will check the student's logic.
2. **Debater / Devil's advocate:** student submits a thesis; the AI actively finds logical fallacies and counter-arguments
3. **Perspective shifter:** AI rewrites or critiques a concept through multiple lenses

Informed by Mollick & Mollick's Assigning AI: Seven Approaches for Students, with Prompts (2023)



<https://uoft.me/3prompts>

# LET'S TEST THEM OUT

- Choose one of the three frameworks from the provided “prompt menu”.
- Select a topic from your specific discipline
  - **Generic topics:**
    - Should cellphones be banned in classrooms?
    - Is remote work better than in-office work?
    - Explain Photosynthesis to a 5-year-old.
- Engage in a 5-turn conversation with the AI
- Don't accept the AI's first answer. Push back. Correct it. Challenge it.

**HOW DO WE ASSESS THE HUMAN  
PROCESS OF WORKING WITH, THROUGH,  
AGAINST AI?**



# VISIBLE THINKING FRAMEWORK

Setup (Inquiry Design)	Friction (Critical Curation)	Synthesis (Metacognition)
<b>Artifact:</b> The student's Initial AI input strategy.	<b>Artifact:</b> Chat Log Highlights (Specifically the "Push Back").	<b>Artifact:</b> Reflection / Defense
<b>Cognitive Skill:</b> Problem Formulation & Domain Knowledge	<b>Cognitive Skill:</b> Evaluative Judgment & Iteration	<b>Cognitive Skill:</b> Self-Regulated Learning
<b>Key Question:</b> Did the student know enough to constrain/frame the AI, or did they ask a generic question?	<b>Key Question:</b> Did the student accept the first few answer, or did they force the AI to refine, correct, or defend its output?	<b>Key Question:</b> Can the student articulate exactly where the AI failed/was not adequate and how they bridged the gap?"

Based on Chi & Wylie's *ICAP Framework*(2014) and Tai et al.'s *Evaluative Judgement*(2018)

# HUMAN LOOP RUBRIC

Criteria	Novice / Passive
<b>Inquiry Design</b> ( <i>Problem Formulation</i> )	<b>Generic:</b> Uses simple, open-ended prompts (e.g., "Tell me about X"). Relies on AI to determine scope.
<b>The Loop</b> ( <i>Iteration &amp; Critique</i> )	<b>Acceptance:</b> Accepts the AI's first response with little change. No evidence of fact-checking.
<b>Reflection</b> ( <i>Metacognition</i> )	<b>Descriptive:</b> "I used AI to write the paper. It was helpful."

*Aligned with Bloom's Revised Taxonomy (Anderson & Krathwohl, 2001)*

# HUMAN LOOP RUBRIC

Criteria	Novice / Passive	Proficient / Active
<b>Inquiry Design</b> ( <i>Problem Formulation</i> )	<b>Generic:</b> Uses simple, open-ended prompts (e.g., "Tell me about X"). Relies on AI to determine scope.	<b>Structured:</b> Uses persona, tone, or format constraints. (e.g., "Act as a critic and analyze X").
<b>The Loop</b> ( <i>Iteration &amp; Critique</i> )	<b>Acceptance:</b> Accepts the AI's first response with little change. No evidence of fact-checking.	<b>Refinement:</b> Asks follow-up questions to clarify or expand. Catches obvious errors.
<b>Reflection</b> ( <i>Metacognition</i> )	<b>Descriptive:</b> "I used AI to write the paper. It was helpful."	<b>Analytical:</b> "The AI was good at structure but bad at details. I had to fix the dates."

*Aligned with Bloom's Revised Taxonomy (Anderson & Krathwohl, 2001)*

# HUMAN LOOP RUBRIC

Criteria	Novice / Passive	Proficient / Active	Advanced / Evaluative
<b>Inquiry Design</b> ( <i>Problem Formulation</i> )	<b>Generic:</b> Uses simple, open-ended prompts (e.g., "Tell me about X"). Relies on AI to determine scope.	<b>Structured:</b> Uses persona, tone, or format constraints. (e.g., "Act as a critic and analyze X").	<b>Constraint-Based:</b> Applies specific theoretical lenses or edge-cases to force high-level output. (e.g., "Analyze X through the lens of Y, accounting for Z").
<b>The Loop</b> ( <i>Iteration &amp; Critique</i> )	<b>Acceptance:</b> Accepts the AI's first response with little change. No evidence of fact-checking.	<b>Refinement:</b> Asks follow-up questions to clarify or expand. Catches obvious errors.	<b>Critique/Curation:</b> Challenges the AI's premises. Identifies hallucinations/bias. Forces the AI to debate or adopt a counter-position.
<b>Reflection</b> ( <i>Metacognition</i> )	<b>Descriptive:</b> "I used AI to write the paper. It was helpful."	<b>Analytical:</b> "The AI was good at structure but bad at details. I had to fix the dates."	<b>Synthetical:</b> "The AI defaulted to a Western-centric view of the topic. I had to intervene to integrate the Global South perspective we discussed in class."

# ADAPTING FOR DIFFERENT DISCIPLINES

For STEM / Coding / Math (The "Debugger" Model)

- **Setup:** Did the student describe the logic/pseudocode before asking for the code?
- **The Loop:** The AI's code rarely works perfectly on the first try (or it writes insecure code).
  - We grade the Debugging Log. How did the student identify the error? Did they recognize that the AI used a deprecated library?
- **Reflection:** "Why is the code efficient? Explain the specific function the AI wrote."

# ADAPTING FOR DIFFERENT DISCIPLINES

For Creative / Ideation Tasks (The "Curator" Model)

*Used in Design, Marketing, or Business Strategy where AI is used to brainstorm.*

- **Setup:** "Generate 20 ideas for a marketing campaign targeting Gen Z."
- **The Loop:** The AI gives 20 generic ideas. The student must select the best one and refine it.
  - We grade the selection Criteria. Why did they throw away the other 19? The "Friction" here is the act of choice.
- **Reflection:** "I chose Idea #7, but I had to change the tone because the AI sounded too corporate."

# ADAPTING FOR DIFFERENT DISCIPLINES

For Clinical / Professional Scenarios (The "Simulation" Model)

*Used in Nursing, Social Work, or Law.*

- **Setup:** The AI plays the patient/client.
- **The Loop:** The student interviews the AI.
  - We grade the Questioning Strategy. Did the student ask the right diagnostic questions? Did they miss a red flag the AI dropped?
- **Reflection:** "I missed the patient's mention of dizziness in turn 3. Next time, I would follow up on that symptom."

# DESIGNING YOUR OWN

- Which specific topic in your course causes students to struggle?
- Which AI archetype (Debater, Socratic Simulator, Perspective Shifter) would your students breakthrough?
- How will you assess their learning?

# Q & A

Would love to hear your thoughts!



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