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Learning Intelligence: A Design AI Primer for Educators

Insights from Future of Innovation Lab x
Lee Kuan Yew Centre for Innovative Cities

Learning Intelligence *offers to educators and learners insights grounded in what we and others are doing and researching. Each piece is short and laser-tight focused on a big topic.*

GOAL:
To design and deliver classroom activities and teaching methods that strengthen cognitive skills, reduce over-reliance on AI-generated answers, and promote deeper engagement with course materials.

SUMMARY:
This guide supports educators in designing activities that foster deep cognitive engagement, reduce AI dependence, and encourage student reflection and self-awareness. Through effortful, reflective tasks balanced with AI use, educators can promote lasting cognitive growth and subject mastery. We present four strategies for cognitive-strengthening teaching and activity design:

1. **Promote Active Recall and Reflection**
2. **Introduce Purposeful Friction**
3. **Leverage Gamification to Motivate Genuine Effort**
4. **Show, Don't Tell**

BIG TOPIC:

Cognitive Strengthening Teaching and Activity Design Guide

Worries are rising rapidly that mindless, frequent, and prolonged use of AI will weaken learning, cognitive abilities, and skills. When we automate our cognitive tasks such as problem-solving and decision-making, we are reducing our own or unassisted ability to "translate information into knowledge and knowledge into know-how".[2, 6, 18]

The worries are warranted. The Lee Kuan Yew Centre for Innovative Cities in SUTD have been studying this risk for close to a decade. In our Singapore National Research Foundation- and Ministry of National Development-funded Future of Cities project – published as Living Digital 2040: Future of Work, Education and Healthcare – we had already identified this risk across a spectrum of human endeavours (see table below). [3]

Image Credit : Based on work for Living Digital 2040: Future of Work, Education and Healthcare [3]

Area	Example of AI/IT Solutions	How Human Cognitive Capabilities Are Affected Negatively (and Why It Matters)
Strategy	Constant use of computational systems that analyse, suggest, propose, advise and guide users through courses of action	Reduced individual and organizational understanding of the competitive situation, thus becoming less able to strategize for the future.
Audit and Accounting	Growing use and even reliance on automated models and solutions	Experts show de-skilling effect over time due to over-reliance, and novices do not acquire the necessary foundational domain expertise; both increase the risks of weaker governance within organizations, especially as issues become increasingly complex.
Skills Mastery (driving and architecture used as representative examples)	- Navigation: use of GPS for driving navigation - Architectural practice: use of Computer-Aided Design (CAD) software	- Regular reliance on GPS results in atrophy in the driver's hippocampus over time; this could pose a long-term health issue as reduced hippocampus activity is associated with higher Alzheimer's risks. - Architects show reduced sense of scale in their designs with constant CAD use; this could diminish their ability to meet the design needs of cities and clients over time.

Hence we have been researching into the strategies to counter these risks and allay worries. We outline four of them in this Learning Intelligence Explainer. In future Explainers, we will elaborate on them with detailed case studies.
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1. **Promote Active Recall and Reflection**
2. **Introduce Purposeful Friction**
3. **Leverage Gamification to Motivate Genuine Effort**
4. **Show, Don't Tell**

A CORE PRINCIPLES AND GUIDELINES

1 Promote Active Recall and Reflection

Encourage active participation and recall through exercises that require students to retrieve, apply, or critically assess knowledge, rather than passively consuming AI-generated solutions. [3, 9, 17]

2 Introduce Purposeful Friction

Design tasks that involve just enough cognitive effort to deepen learning. [3, 4, 7]

3 Leverage Gamification to Motivate Genuine Effort

Use gamification elements to motivate sustained cognitive effort. [3, 8, 16]

4 Show, Don't Tell

Guide students toward finding answers independently rather than immediately providing detailed solutions. [3, 12, 13]

B EXAMPLE CLASSROOM ACTIVITIES

Activity 1: Guess Before Verify

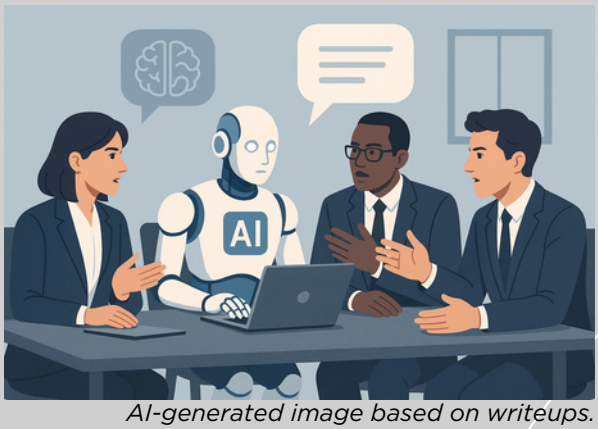
- **Objective:** Develop intuitive understanding and estimation skills.
- **Description:** Present students with challenging problems or scenarios. Require initial attempts or guesses prior to verification using AI or computational tools. [3, 4, 14]

Activity 2: Scenario Reconstruction

- **Objective:** Encourage long-term retention and understanding of complex concepts.
- **Description:** After completing a topic, students reconstruct scenarios or case studies from memory before cross-checking with notes or AI summaries. [1, 3, 11]

Activity 3: Debate the AI

- **Objective:** Enhance critical assessment and analytical skills.
- **Description:** Students compare and debate their own analysis against AI-generated answers, identifying strengths and weaknesses. [3, 10, 15]



AI-generated image based on writeups.

C IMPLEMENTATION CHECKLIST FOR EDUCATORS

- [ ] **Set clear expectations** on when and how AI assistance should be used.
- [ ] **Explicitly discuss** with students how excessive reliance on AI could negatively affect their cognitive skills.
- [ ] **Design activities** that integrate cognitive effort, reflection, and active engagement intentionally.
- [ ] **Provide timely feedback** emphasising growth in independent cognitive abilities.

The checklist provides clear, actionable steps for educators to help students use AI wisely while strengthening their own thinking skills.

It encourages setting boundaries around AI use, designing activities that require active effort and reflection, and giving feedback that promotes cognitive growth. This is valuable because it supports deeper learning and helps students become more self-aware, independent thinkers.

AI-generated image based on writeups.

D PRACTICAL EXAMPLE: REDESIGNING CLASS ACTIVITIES

Before (typical activity):

Students directly use AI tools to generate summaries or answers to case-study questions.

After (cognitive-centred redesign):

Step 1: Students draft their initial response without external help.

Step 2: Students exchange drafts for peer review, challenging peers to identify gaps or biases.

Step 3: Only after initial efforts –allow students to compare their work with AI-generated responses. Facilitate discussions about differences, biases, and errors discovered.

EVALUATION AND FEEDBACK

Ongoing Cognitive Analytics

- Provide regular analytics or summaries highlighting students' progress in tasks demanding cognitive effort.
- Include metrics that emphasise independent problem-solving, accuracy improvements over time, and ability to critique and refine AI-generated content.

AI-generated image based on writeups.

Note: *Co-updated with an ensemble of Humans ∞ AI based on original work first developed almost a decade ago. The accelerating AI advances demand a more agile and adaptive strategy to designing the future of learning and education with AI as tool, teammate, and neither. We encourage continuous reflection and adaptation of these strategies based on student feedback and classroom dynamics. We are doing the same.*

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