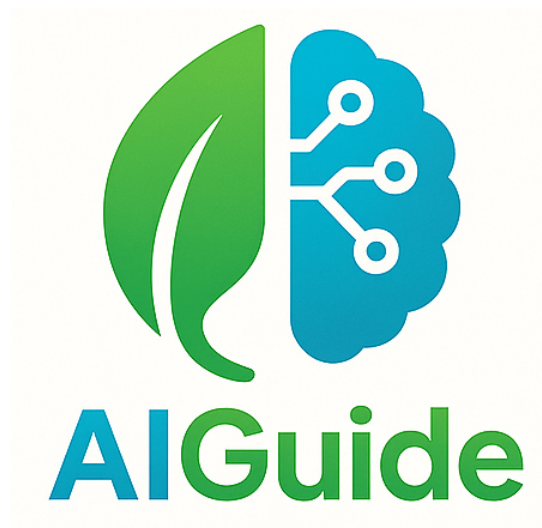




ONLINE COURSE CONTENT

MODULE 5: DESIGNING AI-ENHANCED LEARNING EXPERIENCES

2025-1-LT01-KA220-HED-000354784

Artificial Intelligence for Green Understanding, Insights & Decision Empowerment



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A. General Information

Module No.	Module 1 Module 2 Module 3 Module 4 Module 5
Subtopic 5.1	Designing AI-Enhanced Learning Experiences
Artificial Intelligence Literacy Component	AI integration in education; human–AI collaboration in learning design; instructional alignment.
Decision-Making Skills	Selecting AI-supported learning strategies; evaluating usefulness and feasibility of AI.
Teacher Learning Outcome	Designs AI-enhanced learning experiences for STEM higher education aligned with module outcomes.
Student Learning Outcome	Makes justified decisions about how AI can support their own learning.
Possible Tools	ChatGPT; Gemini; Claude; LMS tools.
AI Literacy Level	Basic
Estimated Time	90 minutes in total: a 30-minute faculty development session (Section B) and a 60-minute student activity (Section D), plus optional independent preparation

B. Content for STEM Higher Education Faculty

Key Points

- An AI-enhanced learning experience is grounded in adaptivity: the system detects a learner’s specific needs and applies appropriate pedagogy through feedback, content sequencing and varied presentation.
- Learning outcomes are determined by the design of the AI activity, not by the mere presence of AI.
- The design space is wider than a chatbot on a screen; it also includes LMS-based adaptation and, conceptually, cobots and smart classrooms.
- Didactic decisions – what to teach, in which sequence, by which criteria, and when to intervene – remain with the teacher; AI executes adaptation, dialogue and feedback.
- Alignment is double: with the module outcome and with students’ real conditions – language, access, prior knowledge, confidence.
- Design starts from the module outcome and the learning problem, and only then selects the AI function and the tool.

Introduction

Many teaching decisions in STEM higher education concern how learning is supported: which explanations, practice, feedback and pacing a diverse group of students receives. Designing an AI-enhanced learning experience is the deliberate use of artificial intelligence to provide that support where it is otherwise scarce, in a way that serves a defined module outcome. This section gives the teacher the primary knowledge needed to make and justify such designs before running the session.

The starting point is the recognition of individual differences: because the learning process is different for each and every learner, adaptive educational systems combine two capabilities – comprehending and detecting a person’s specific learning needs, and applying appropriate pedagogy to enhance the learning



process (Colchester et al., 2017). The teacher therefore does not “add a tool”; they decide which adaptive function to attach to a concrete outcome.

Activity: Observe—Notice | AI tutoring in action (3 min)

Task: Watch a short demonstration of a dialogue-based AI tutor (e.g., Sal Khan’s Khanmigo demo). Which pedagogical moves do you notice – questioning, hinting, re-explaining, checking? Expected focus: the tutor adapts its next move to the learner’s previous answer, illustrating feedback and varied presentation as adaptation mechanisms (Colchester et al., 2017).

Resource: Sal Khan, “How AI could save (not destroy) education” (TED) ·

https://www.ted.com/talks/sal_khan_how_ai_could_save_not_destroy_education

Concepts to Define at the Start

Before the session, the teacher should be able to define four terms crisply. Artificial Intelligence in Education (AIED) builds systems that model the learner and adapt pedagogical action. An adaptive learning system combines detecting a person’s specific learning needs with applying appropriate pedagogy to enhance the learning process (Colchester et al., 2017). The learner model is a data-based profile of knowledge level, affective state, personality traits and skills, used either to inform the pedagogy proposed by the system’s designers or to give the system dynamic self-learning capabilities from teachers’ and students’ behaviour (Colchester et al., 2017). Instructional alignment is the requirement that outcomes, activities and assessment form one coherent chain.

Environment, Adaptivity and the Learner Model

Adaptation operates through three mechanisms the teacher should name explicitly, because every AI-enhanced design realises one or more of them: feedback, content sequencing, and presentation of materials in different teaching-style approaches (Colchester et al., 2017). A chat interface (ChatGPT, Gemini, Claude) typically delivers feedback and varied presentation through dialogue; LMS tools deliver sequencing, conditional release and monitoring. The efficiency of any adaptive design depends on how well the learner’s needs and characteristics are detected and used (Colchester et al., 2017).

Activity: Research and Learn | Adaptive systems and design (30 min, independent preparation)

Task: Read the overview of adaptive educational systems and identify, for your own module, one place where feedback, one where sequencing, and one where varied presentation is currently missing. These three “gaps” are candidate points for AI support (Colchester et al., 2017).

Resource: UNESCO AI Competency Framework for Teachers (2024) ·

<https://www.unesco.org/en/articles/ai-competency-framework-teachers>

Key Concepts

Concept	Key Focus	Key Components	Evidence of Learning
AI-enhanced learning experience	Adaptive support attached to a defined outcome	Learner model; feedback, sequencing, presentation (Colchester et al., 2017)	The teacher names the adaptive function and links it to a module outcome
Human–AI collaboration in design	Division of labour: teacher decides, AI executes	Knowledge co-engineering; prompting as specification (Porayska-Pomsta, 2016)	The teacher keeps the didactic decisions and interpretation



What Makes a Learning Experience “AI-Enhanced”?

An AI-enhanced learning experience is any configuration in which AI performs an adaptation, dialogue, feedback or orchestration function in service of a learning outcome – not only a chatbot on a screen. Timms (2016) argues the field is mature enough to move “out of the box” towards educational cobots (robot co-workers supporting learners at different paces) and smart classrooms using sensors and natural-language interaction. This breadth matters at the design stage: the same outcome might be served by a chat dialogue, an adaptive LMS sequence, or a richer embodied configuration.

Key control question:

Which module outcome does the AI activity serve, and which adaptive function – feedback, sequencing or varied presentation – does it provide that a non-AI alternative could not provide as well?

At Which Stages Does the Design Take Shape?

An AI-enhanced learning experience is not designed in a single decision; its quality is built across a sequence of stages, at each of which the teacher makes a didactic choice and, where appropriate, delegates execution to AI. Outcomes are determined by how the design is aligned, not by the presence of AI as such (Cheung, 2026).

Stage	Key Question	Expected Action from a Design Perspective	AI Support
1	What is the outcome?	The module outcome is stated in observable terms	Rephrasing outcome statements; suggesting observable verbs
2	What is the learning problem?	The missing feedback, sequencing or presentation is identified (Colchester et al., 2017)	Organising known misconceptions from existing materials
3	Which function, then which tool?	The AI function is chosen first; the tool second	Comparing functions; drafting a first version of the activity
4	Is it useful and feasible?	Alignment, added value, fit with students’ conditions, reliability and workload are evaluated	Generating draft materials and level variants to test feasibility
5	How will it be assessed?	An assessment is planned, including an AI-free measure	Drafting rubric items and practice questions for review
6	What happened?	The activity is reviewed against evidence and adjusted	Summarising student outputs and flagging patterns

Alignment and Evidence

Evidence the teacher should be able to cite from memory: a GPT-powered chatbot designed around self-regulated learning theory (SRLbot) significantly increased goal setting, time management, help seeking, science motivation and knowledge, outperforming a comparison bot (Ng et al., 2024, as cited in Cheung, 2026). Teachable agents that students must “teach” targeted competence beliefs (Chin et al., 2013, as cited in Cheung, 2026); scenario-driven serious games targeted epistemic affect (Ferro et al., 2021, as cited in Cheung, 2026); inquiry-structured conversation flows developed self-competence in scientific practices (Chang et al., 2023, as cited in Cheung, 2026). Documented failures make the second dimension concrete: an English-only agent remained unused because of linguistic barriers, and some students preferred a plain



search engine when the bot returned long, inaccurate answers (Cheung, 2026). Alignment is therefore always double.

Human–AI Collaboration in Design

AI in design is not only back-end functionality but a “technology of the mind” through which teachers represent, compare and test their pedagogical decisions and predict their impact on individual learners (Porayska-Pomsta, 2016). Specifying audience, prior knowledge, target outcome, typical misconceptions and interaction style translates tacit expertise into an explicit specification the AI executes – “knowledge co-engineering”. The critical caveat: current systems analyse the student far more than they support teachers’ reflection on their own practice, so interpretation and responsibility remain structurally with the educator (Porayska-Pomsta, 2016).

Appropriate scope of tasks:

AI can generate drafts, variants, explanations and practice items and help structure the design. The module outcome, the choice of adaptive function, the alignment judgement and the final design decision are determined by the teacher (Porayska-Pomsta, 2016).

Evidence-Based Decision-Making Cycle (Discipline-Specific)

The evidence-based decision-making cycle is applied here in a discipline-specific manner using the 5E workflow (Bybee et al., 2006), in the form adopted across AIGUIDE Module 3, Subtopic 3.7. AI supports the evidence, comparison and communication stages; verification, the final choice and professional responsibility remain with the human.

Stage	Key Question	Appropriate AI Support	Human Responsibility
Engage	What decision must be made, and what are its limits?	Reframes the question; points out what the statement of the problem is missing	States the decision and the environmental indicator (energy use per m ³ treated)
Explore	a. What data, standards and sources are needed? b. What are the criteria and constraints?	a. Locates and organises sources and proposes variables. b. Reads standards and regulations for criteria	a. Verifies sources and data quality. b. Judges which criteria fit this problem
Explain	How do the options perform under those criteria?	Builds the comparison table, scenarios and counterarguments	Names the assumptions and the system boundary used
Elaborate	Which option is professionally defensible?	Drafts the justification and supports its presentation	Makes the final choice and reports the rationale
Evaluate	What was verified, rejected or left uncertain?	Flags inconsistencies and missing evidence	States the boundaries and uncertainties of the decision, without AI

Tools That Can Be Used in This Subtopic

- ChatGPT / Gemini / Claude – dialogue-based tutoring and Socratic questioning; explaining at several levels; generating worked examples and practice variants; drafting an activity and its rubric for review.
- LMS tools – adaptive quiz sequences, conditional release of remedial materials, and monitoring – the course-level realisation of feedback, sequencing and presentation (Colchester et al., 2017).



Critical and Responsible Use

- Every factual claim, worked solution or reference in AI-drafted material is verified against a reliable source before it reaches students (Cheung, 2026).
- The design is checked for double alignment: with the outcome and with students' language, access, prior knowledge and confidence (Cheung, 2026).
- Didactic decisions and interpretation remain with the teacher; the AI's role is disclosed to students (Porayska-Pomsta, 2016).
- An AI-free measure of the outcome is planned, so independent mastery can be checked.
- The environmental footprint of the chosen tool is weighed against its learning benefit; not every task needs a large model (Vinuesa et al., 2020).

Videos and Interactive Resources (Additional Sources for the Lecturer)

Additional resources for the lecturer. Items marked [S] are recommended during the 30-minute faculty development session and take about 10 minutes in total; items marked [I] are for independent preparation and are not counted in the session time. Links were checked and are stable; if a link changes, search the resource title.

- **[I] Sal Khan – “How AI could save (not destroy) education” (TED, ~15 min):** vision of a personal AI tutor for every student and an AI assistant for every teacher; a strong opener on what an AI-enhanced learning experience is. https://www.ted.com/talks/sal_khan_how_ai_could_save_not_destroy_education
- **[S] Khan Academy – “Khanmigo: In-Depth Demo” (YouTube, ~10 min):** Sal Khan shows live how an AI tutor guides a student to understanding instead of giving the answer – illustrates dialogue, feedback and adaptation. <https://www.youtube.com/watch?v=rnIgnS8Susg>
- **[I] UNESCO – AI Competency Framework for Teachers (2024):** 15 competencies as a design reference frame for AI-enhanced teaching. <https://www.unesco.org/en/articles/ai-competency-framework-teachers>

Guidance Flowchart for Professional Development

Stage	Activity
Understanding adaptivity	Watch an AI-tutoring demonstration and name the adaptation mechanisms (feedback, sequencing, presentation).
Subject knowledge	Review adaptive-systems theory and the learner-model construct (Colchester et al., 2017).
Understanding the design process	Work through the six design stages for one module outcome.
Reading the evidence	Examine how design mechanisms map onto outcome types (Cheung, 2026).
Collaboration awareness	Practise “knowledge co-engineering”: turn a pedagogical intention into a precise prompt (Porayska-Pomsta, 2016).
Creating your own example	Complete a design brief for your own STEM module.



C. Real-Life Example

Illustrative Teaching Scenario: Designing a Chatbot-Supported Unit in Environmental Engineering

A lecturer in environmental engineering wants students to compare two water-treatment options on a stated environmental indicator and justify a preference – a life-cycle-aware decision. The module outcome is observable: “students can compare two treatment options on a chosen indicator (e.g., energy use per m³ treated) and justify a preference.” The learning problem is that, in a large cohort, students receive little individual feedback while reasoning through such trade-offs.

Following the six stages, the lecturer selects a dialogue function and builds a guided chatbot activity in which the conversation flow is structured around inquiry steps (after Chang et al., 2023, as cited in Cheung, 2026): the chatbot prompts students to state the indicator, list options and defend a preference, while the lecturer’s rubric defines an acceptable justification. An LMS adaptive quiz then releases a remedial explanation to students who miss the life-cycle boundary concept. Every figure the chatbot uses is verified against an authoritative environmental dataset, and an AI-free written justification is the graded measure. This mirrors documented practice such as Khanmigo’s Socratic tutoring pattern (AIGUIDE Best Practices Report, 2026, Section 3.3).

If no chatbot access is available:

The teacher provides a scripted dialogue (a printed “chatbot transcript”) and a worked comparison; students complete the same justification task in pairs. The design logic – outcome, function, alignment, AI-free measure – is identical.

Preparing Your Own Real-Life Example

- Select a real teaching context in environmental science, engineering, bioengineering or biology where individual feedback, adapted presentation or dialogue is scarce.
- State the module outcome in a single observable sentence.
- Identify the adaptive function (feedback, sequencing or presentation) that best serves it, and only then the tool.
- Define the double-alignment check: fit with the outcome and with students’ language, access and prior knowledge.
- Describe the AI-free measure you will use to confirm independent mastery.



D. Interactive Learning Activity

Student Learning Activity Card

For STEM university students

Project	Artificial Intelligence for Green Understanding, Insights & Decision Empowerment (AIGUIDE)
Module / Subtopic	Module 5 / Subtopic 5.1 – Designing AI-Enhanced Learning Experiences
Activity Code	M5-A3.5-S1
Event Title	Deciding How AI Will Support Your Own Learning on a Green-STEM Task
Developing Partner	VMU / AIGUIDE Consortium
STEM Context / Discipline	Interdisciplinary STEM; energy, environment, materials, engineering, bioengineering, biology.

1. Activity Description

Recommended Duration	60 minutes + optional preparation
Delivery Format	☒ In-class ☐ Synchronous online ☐ Asynchronous online
Student Grouping	☐ Individual ☒ Pairs ☒ Small groups (3–4 students)
Summary	Students plan their own learning on a given green-STEM task: they state what they must be able to do unaided, identify where their own learning is least supported, decide which AI function to use and which not, and specify how they will prove the result without AI.

2. Pedagogical Design

Learning Objectives	By the end, students will: (1) state observably what they must be able to do; (2) identify where their own learning lacks feedback, sequencing or explanation; (3) choose the AI function before the tool and justify it; (4) check the choice against their own language, access and prior knowledge; (5) specify how they will demonstrate mastery without AI.
Goal: AI Literacy	☒ Understanding AI concepts ☒ Using AI tools critically ☒ Evaluating AI outputs ☐ Building AI systems
Focus on Green Decision-Making	☒ Climate change ☒ Energy ☒ Materials/resources ☐ Biodiversity
Prerequisite Knowledge	Basic familiarity with the module's subject matter, its outcomes and one AI chat tool.
Key Concepts	AI-enhanced learning experience; adaptation mechanisms; learner model; instructional alignment; human–AI collaboration. The five steps of this activity follow the 5E workflow: Engage → Explore → Explain → Elaborate → Evaluate (Bybee et al., 2006).



3. Design of the Student Assignment

Student Scenario / Assignment	Goal: to decide, with evidence, how AI will and will not support your own learning on a green-STEM task. Context: the task is to compare two water-treatment options on energy use per m ³ treated and justify a preference. You have one chat tool and one authoritative environmental dataset. Plan your own route to the decision, use AI only where you can say why, and state how you will prove the result without it.
Student Guidelines	Step 1 (Engage) – State observably what you must be able to do. Step 2 (Explore) – Identify where your own learning lacks feedback, sequencing or explanation, and gather the data and criteria. Step 3 (Explain) – Choose the AI function first, then the tool, and compare the two options under the criteria. Step 4 (Elaborate) – Make the decision and report the rationale. Step 5 (Evaluate) – Prove the result without AI and state what remains uncertain.
Input Materials	☐ Dataset ☒ Case study text ☒ Article ☐ Image/video ☒ A given module outcome
Expected Student Output	☒ Short design brief ☒ One-page justification ☒ Presentation ☐ Working prototype
Submission Format	A one-page design brief plus a short justification, or a 5-slide presentation of the same.

4. Use of Artificial Intelligence and Sustainable Decision-Making

Recommended AI Tools	• ChatGPT / Gemini / Claude – to draft the activity, generate practice variants and rehearse the tutoring dialogue. • LMS tools – to plan the adaptive sequence and monitoring.
AI Prompt / Interaction Guide	Sample prompt: “You are helping design a learning activity for [audience] whose outcome is [observable outcome]. A common misconception is [X]. Propose a dialogue that leads students to [outcome] through questioning, and list two practice items at different difficulty levels.”
Critical Evaluation	Students evaluate every output for factual accuracy against a source, for fit with their own prior knowledge and language, and for whether it does something a non-AI route could not do as well.
Human Decision Component	Students determine the outcome, the function AI is allowed to perform, the verification judgement and the final decision; the AI drafts and varies, it does not decide.
Responsible AI / Ethics Note	Only publicly available material is used; no personal or sensitive data is entered into public tools; the tool’s footprint is weighed against the learning benefit (Vinuesa et al., 2020).
AI Usage Log	A brief, four-part log: (1) How did AI contribute? (2) Which outputs were independently verified? (3) Which outputs were corrected or rejected? (4) What is the final decision and on what evidence does it rest?

5. Evaluation and Evidence

Evaluation Method	☒ Checklist ☒ Graded rubric ☒ Peer feedback ☒ Teacher assessment
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Assessment Criteria	1. Disciplinary accuracy; 2. Evidence-based reasoning; 3. Critical and transparent use of AI; 4. Sustainability trade-offs; 5. Clear and human-driven final decision; 6. Explicit statement of the adaptive function and of the AI-free measure of mastery.
Evidence to Be Collected	☒ Design brief ☒ Screenshot of AI interaction ☒ Justification text ☒ Peer-feedback form
Success Criteria	Sufficient performance on at least five of the six criteria; the final decision is made under human responsibility and supported by evidence-based justification.
Feedback Questions	1. Which adaptive function did your design rely on, and why? 2. How did you check alignment with students' real conditions? 3. What would you measure without AI to confirm the outcome?

6. Application Notes

Teacher Preparation	Review Subtopic 5.1 and prepare 3–4 green-STEM module outcomes to distribute; test the chosen AI tool in advance.
Time Schedule	Introduction & demonstration: 10 min Decision work: 30 min Presentations & critique: 15 min Reflection: 5 min.
Accessibility / Inclusion	Allow students to work in their most proficient language; provide outcome statements in writing; offer a non-AI design path.
Potential Risks	No access to the AI tool; AI-generated facts taken at face value; design that adds a tool without a matching outcome.
Precautions / Contingency Plan	Provide a printed “chatbot transcript” and worked example as backup; require source verification for every AI-stated fact.

Step-by-step implementation. The screenshots named below are captured by the teacher from the tool actually used and inserted before delivery.

Step	What the teacher does	What to capture as evidence
1. Prepare	Distribute the task and the authoritative dataset; test tool access for all students.	Task sheet and dataset
2. Demonstrate	Show one AI-tutoring exchange and name the adaptation mechanism live; capture a screenshot of the dialogue.	Screenshot of the dialogue
3. Run	Students work through the five 5E steps, recording the function chosen before the tool.	Decision brief
4. Review	Pairs critique each other's brief against the criteria and constraints.	Peer-feedback form
5. Close	Each student writes the AI-free justification and completes the AI Usage Log.	AI-free justification and AI Usage Log

Joint Completion Checklist

No.	Checkpoint	Completed
1	The module outcome is stated in observable terms.	☐



2	The learning problem (missing feedback/sequencing/presentation) is identified.	☐
3	The AI function is chosen before the tool.	☐
4	Double alignment (outcome + students' conditions) is checked.	☐
5	All AI-drafted facts are verified against a source.	☐
6	An AI-free measure of the outcome is specified.	☐
7	Responsible-use and footprint notes are included.	☐
8	Every design decision is justified with the taught principles.	☐



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