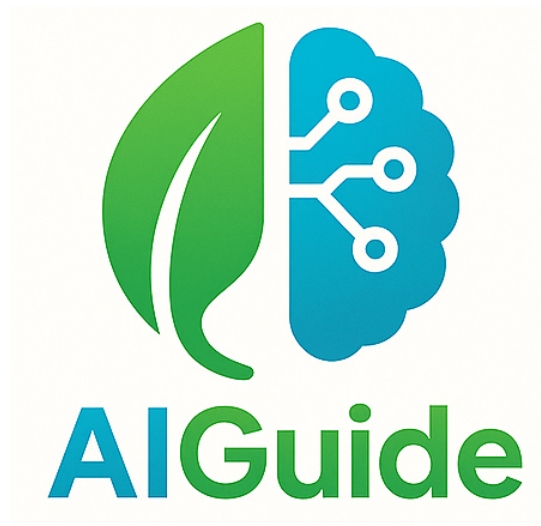




ONLINE COURSE CONTENT

MODULE 5: USING GENERATIVE AI FOR TEACHING AND LEARNING

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 5.2	Using Generative AI for Teaching and Learning
Artificial Intelligence Literacy Component	Generative AI functions; text/image/code generation; limitations of generative AI; content adaptation.
Decision-Making Skills	Evaluating appropriateness of AI use; comparing AI vs non-AI strategies.
Teacher Learning Outcome	Uses generative AI to develop learning materials, examples, activities and support resources.
Student Learning Outcome	Evaluates when and how generative AI can appropriately support learning.
Possible Tools	ChatGPT; Gemini; Claude; Canva AI; GitHub Copilot.
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

- Generative chatbots (ChatGPT, Gemini, Claude) create novel output; unlike rule-based bots, their content is not pre-verified.
- Documented benefits are real but conditional: knowledge gains, better recall, higher motivation and confidence, lower cognitive load – alongside documented inaccuracy.
- Every fact, formula, figure and reference in generated material must be verified before it reaches students.
- Generated content inherits training-data bias; AI is a useful tool but not a replacement for students' own creative work.
- Content adaptation multiplies one verified base material into levels, languages and formats – the teacher's added value is curation and alignment.

Introduction

This subtopic equips teachers to develop learning materials, examples, activities and support resources with generative AI. Functionally, generative tools explain and re-explain concepts at different levels, generate worked examples, practice tasks and scenarios, summarise and repeat topics on demand, produce visual materials and generate or explain code – functions that map directly onto the adaptation mechanisms of adaptive-systems theory: feedback, sequencing and varied presentation (Colchester et al., 2017). Students themselves describe chatbots as helping to summarise, repeat and “lecture” a topic (Cheung, 2026).

The decisive professional skill is not producing material but judging and curating it: knowing when generative AI adds value and when it must be verified or avoided. This section gives the teacher that judgement, grounded in the empirical record of benefits and limitations.



Activity: Observe—Notice | Prompt anatomy in action (3 min)

Task: Watch a demonstration of a teacher building a prompt. Identify the four parts – role and goal, pedagogy, constraints, step-by-step instructions (Mollick & Mollick, 2023). Expected focus: how specifying audience and misconceptions changes the quality of the generated material.

Resource: Google “Generative AI for Educators with Gemini” · <https://grow.google/ai-for-educators/>

Concepts to Define at the Start

An AI chatbot is a system that simulates a human conversation across modalities such as images, text and voice (Labadze et al., 2023, as cited in Cheung, 2026). Draw the key distinction: generative chatbots built on large language models (ChatGPT, Gemini, Claude) produce novel output; rule-based chatbots detect the semantics of the input and return pre-designed responses (Cheung, 2026). The practical consequence for teaching is that generative tools are far more flexible, but their content is not pre-verified.

Generative AI Functions

In teaching and learning, generative AI explains at adjustable levels, generates worked examples and practice tasks, summarises and repeats on demand, sustains self-study dialogue, produces visuals, and generates and explains code. These functions map onto the adaptation mechanisms of adaptive-systems theory – feedback, sequencing and varied presentation (Colchester et al., 2017) – which is why generative AI spread so quickly through practice: it makes low-cost, on-demand versions of functions previously engineered at high cost.

Activity: Research and Learn | Benefits and limits (30 min, independent preparation)

Task: Using the AI Pedagogy Project, prompt a chatbot for an explanation plus five “facts with references” in your discipline, then verify each claim and reference. Record the error rate and error types – this calibrates trust in generated material (Cheung, 2026).

Resource: AI Pedagogy Project (metaLAB, Harvard) · <https://aipedagogy.org/>

Key Concepts

Concept	Key Focus	Key Components	Evidence of Learning
Generative vs rule-based AI	Novel output vs pre-designed responses	LLM chatbots; semantic-match bots; content not pre-verified (Cheung, 2026)	The teacher explains why generated content must be verified
Content adaptation	Reworking one verified base into levels, languages, formats	Simplification, differentiation, translation (Colchester et al., 2017)	The teacher produces aligned variants and curates them

Text, Image and Code Generation

Text generation (ChatGPT, Gemini, Claude) covers explanations at several levels, worked examples, practice sets with answers, case scenarios, discussion questions and support resources. Its quality depends on a pedagogically rich prompt: audience, prior knowledge, target outcome, format and typical misconceptions – a direct application of “knowledge co-engineering” (Porayska-Pomsta, 2016). Image generation and layout belong to Canva AI (illustrations, diagrams, slide and handout design – especially valuable in STEM, where understanding rests on representations). Code generation belongs to GitHub Copilot (and, in chat form, the LLMs): examples, task scaffolds, test cases and line-by-line explanations – with the professional rule of reading and testing every generated line.



The Documented Benefits

Chatbot-supported groups achieved significant knowledge gains on topics such as states of matter and kinematics – in the kinematics study the experimental class contained more high achievers, 72% of students were excited to use the bot and 88% considered it necessary (Cheung, 2026). A quiz-oriented bot improved recall of scientific facts; the SRL-oriented bot significantly increased science motivation and self-regulatory behaviours (Ng et al., 2024, as cited in Cheung, 2026); students improved self-confidence and were comfortable making mistakes; and AR lessons supported by a generative pedagogical agent within the 5E model produced better achievement with lower cognitive load (Cheung, 2026). Students used the bots for rehearsal, consolidation and pacing – formative functions – rather than for discovering new knowledge (Cheung, 2026).

The Documented Limitations

Factual unreliability is documented in classrooms: bots “cannot answer all questions”, sometimes crash, and return long or inaccurate material – to the point that some students preferred a plain search engine (Cheung, 2026). Bias is inherited from training data: algorithms act as a “mirror” of the biases in the data and can amplify discrimination at scale (Vinuesa et al., 2020), summarised in assessment research as “bias, bias everywhere” (Krist & Kubsch, 2023, as cited in Cheung, 2026). Epistemically, generative systems can misrepresent how scientific knowledge is produced and validated (Cheung & Zhang, 2026, as cited in Cheung, 2026), so they are not authorities on methodology. AI is “a useful tool but not a replacement” for students’ own creative work (Behrens et al., 2024, as cited in Cheung, 2026), and interest sparked by novelty does not automatically become disciplinary affect (Fidan & Gencel, 2022, as cited in Cheung, 2026).

Key control question:

Does the generative-AI task supply a function that is otherwise scarce (repeated explanation, immediate feedback, variation), or does it replace the learner’s own reasoning, retrieval and production?

Content Adaptation

Content adaptation reworks existing material to another level, format or language: simplification, differentiation, summaries, example variations, translation, format change. Its theoretical basis is the adaptive-systems principle that material should be presented in different teaching-style approaches to different learners (Colchester et al., 2017). The safe workflow: supply a verified base (so the tool rearranges rather than invents facts), specify the adaptation target and audience, generate variants, then select, correct and align. Because material inaccessible in a student’s language goes unused (Cheung, 2026), language and access are part of the adaptation, not an afterthought.

A Theoretical Criterion of Appropriateness

Generative AI adds value where it supplies functions that adaptive-systems theory identifies as pedagogically productive and that are otherwise scarce – repeated explanation at adjustable levels, immediate feedback, variation of examples, summarisation and differentiation (Colchester et al., 2017; Cheung, 2026). It subtracts value where it substitutes for the learner’s own generative activity – the reasoning, retrieval and creative production in which learning is constituted – or where its unreliability contaminates the course knowledge base (Cheung, 2026).

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 must you be able to do unaided, and what are the limits of the task?	Reframes the task; identifies gaps in your statement of it	States the learning goal and the green-STEM topic to be mastered
Explore	a. Which sources and data are authoritative here? b. What are the criteria for acceptable material?	a. Drafts explanations, examples and visuals at several levels. b. Lists the claims that need checking	a. Verifies every fact and reference against a primary source. b. Sets the acceptance criteria
Explain	Which generated content survives verification, and why?	Produces comparisons, counterexamples and level variants	Records what was corrected or rejected, and on what evidence
Elaborate	Which material is defensible enough to rely on?	Assembles the pack and supports its presentation	Decides what to keep and states the sustainability trade-off of the tool used
Evaluate	What was verified, rejected or left uncertain?	Flags inconsistencies and missing evidence	Demonstrates understanding without AI and names the remaining uncertainty

Tools That Can Be Used in This Subtopic

- ChatGPT / Gemini / Claude – explanations, task sets, scenarios, support resources; content adaptation into levels and languages.
- Canva AI – illustrations, diagrams, and slide/handout layouts for STEM representations.
- GitHub Copilot – code examples, task scaffolds, test cases and line-by-line explanations (every line read and tested).

Critical and Responsible Use

- Every fact, formula, figure and reference is verified against the textbook, lecture material or a primary source before use (Cheung, 2026).
- Examples, contexts and language are checked for bias and inclusivity (Vinuesa et al., 2020; Krist & Kubsch, 2023, as cited in Cheung, 2026).
- Generated material is not used to replace the activities in which the learner's own production constitutes learning (Behrens et al., 2024, as cited in Cheung, 2026).
- AI use in preparing materials is disclosed; students disclose their own AI assistance.
- No personal or confidential data is entered into public tools; the tool's footprint is weighed against the benefit (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] Google – “Generative AI for Educators with Gemini” (free, ~2 h, with certificate):** self-paced course on saving time, personalising teaching and enriching lessons with generative AI. <https://grow.google/ai-for-educators/>



- [S] CGP Grey – “How Machines Learn” (YouTube, ~9 min): engaging animated explainer of how learning algorithms work and why they depend on data; suitable from secondary to university. <https://www.youtube.com/watch?v=R9OHn5ZF4Uo>
- [I] “Why is AI so bad at spelling?” (TechCrunch explainer): why generative models seem to read text but actually reproduce patterns – a concrete way into the limitations of generative AI. <https://techcrunch.com/2024/03/21/why-is-ai-so-bad-at-spelling/>
- [I] AI Pedagogy Project (metaLAB at Harvard): curated assignments and an AI guide for hands-on exploration of AI capabilities and limitations. <https://aipedagogy.org/>
- [I] Elements of AI (University of Helsinki & MinnaLearn): free foundational course, available in Lithuanian, combining theory with practical exercises. <https://www.elementsofai.com>

Guidance Flowchart for Professional Development

Stage	Activity
Understanding generative AI	Distinguish generative from rule-based chatbots and name their functions (Cheung, 2026).
Prompt craft	Practise the four-part prompt structure (Mollick & Mollick, 2023).
Producing material	Generate one artefact (task set, infographic, code scaffold) with the five-stage routine.
Verifying	Run the error-hunt: verify every generated fact and reference (Cheung, 2026).
Adapting	Produce level and language variants of one verified base (Colchester et al., 2017).
Creating your own example	Assemble a small resource pack for your module and peer-review it.



C. Real-Life Example

Best Practices Report Case: Canva (Magic Studio) – Content Creation for Teaching

The AIGUIDE Best Practices Report documents Canva’s Magic Studio as a content-creation and presentation tool with education-specific functions (AIGUIDE Best Practices Report, 2026, Content Creation & Presentation Tools). The report records that Magic Write drafts structured lesson content and STEM materials, Magic Media generates custom scientific illustrations and infographics, and Magic Switch converts and translates materials into many languages for multilingual STEM classrooms – directly realising the content-adaptation principle of presenting material in different forms for different learners (Colchester et al., 2017).

As a concrete teaching example from the report, a lecturer can use Canva to generate, within minutes, a structured presentation on a sustainability topic such as circular-economy principles, together with a life-cycle infographic and level-adapted handouts. The report’s framing makes the decisive point for this subtopic: the tool produces drafts quickly, so the teacher’s verification and curation – not production speed – is the quality factor (AIGUIDE Best Practices Report, 2026). Every figure and mechanism in the generated material is verified against an authoritative source, and examples are checked for bias before use (Cheung, 2026; Vinuesa et al., 2020).

The report situates such content-creation AI alongside the generative assistants it documents – ChatGPT, Claude for Education, Gemini for Education and Microsoft Copilot Chat – giving the lecturer a documented toolset for developing learning materials, examples, activities and support resources.

If the main tool is not available:

If Canva AI is not available: the lecturer generates the text variants in a chat tool and pairs them with an existing licensed diagram; the production routine – prompt, variants, verify, align, curate – is unchanged.

Preparing Your Own Real-Life Example

- Choose a documented content-creation case from the Best Practices Report (e.g., Canva Magic Studio) and a green-STEM topic.
- Write one pedagogically rich prompt (audience, prior knowledge, outcome, format, misconceptions).
- Generate level and language variants plus one visual, then verify every fact and reference against a source.
- Check examples and language for bias and inclusivity.
- Align each artefact to the unit outcome and record what you changed.



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 5.2 – Using Generative AI for Teaching and Learning
Activity Code	M5-A3.5-S2
Event Title	Deciding When Generative AI Helps Your Own Learning on a Green-STEM Topic
Developing Partner	VMU / AIGUIDE Consortium
STEM Context / Discipline	Interdisciplinary STEM; environment, energy, materials, 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 prepare the study material they will themselves rely on for a green-STEM task, verify every claim in it, and judge for which parts of their own learning the generative tool was appropriate and for which it was not.

2. Pedagogical Design

Learning Objectives	By the end, students will: (1) state what they must be able to do unaided; (2) write a prompt that targets their own gap; (3) verify every fact and reference before relying on it; (4) check the output for bias and missing perspectives; (5) judge for which parts of their own learning the tool was appropriate.
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	Familiarity with the topic and with one generative AI tool.
Key Concepts	Generative vs rule-based AI; content adaptation; hallucination/unreliability; bias; appropriateness criterion. 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, for which parts of your own learning a generative tool is appropriate. Context: you are preparing for an assessed task
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	on the recycling of lithium-ion battery materials. You have one generative tool and two authoritative sources supplied by the teacher (an EU recycling-rate statistic and a life-cycle inventory extract). Produce the study material you would actually rely on, verify every claim against those sources, and record where the tool advanced your learning and where it did not.
Student Guidelines	Step 1 (Engage) – State what you must be able to do unaided. Step 2 (Explore) – Write the prompt that targets your own gap and gather the authoritative sources. Step 3 (Explain) – Verify every fact and reference and check the output for bias and missing perspectives. Step 4 (Elaborate) – Decide which material you will rely on and why. Step 5 (Evaluate) – Judge for which parts of your learning the tool was appropriate, and demonstrate the result without it.
Input Materials	☒ Dataset ☒ Case study text ☒ Article ☒ Image/video ☐ Other
Expected Student Output	☒ Resource pack ☒ Verification log ☒ Infographic ☐ Working prototype
Submission Format	A short resource pack with a one-page verification log recording every checked fact and source.

4. Use of Artificial Intelligence and Sustainable Decision-Making

Recommended AI Tools	• ChatGPT / Gemini / Claude – text and adaptation. • Canva AI – visuals and layout. • GitHub Copilot – code scaffolds (every line read and tested).
AI Prompt / Interaction Guide	Sample prompt: “Create a three-level explanation of [topic] for [audience]; include one common misconception per level and two practice questions with worked answers. List any sources you rely on so I can verify them.”
Critical Evaluation	Students verify every fact and reference against the supplied sources, review examples for bias and missing perspectives, and remove any claim they cannot trace.
Human Decision Component	Students decide what to keep, correct and rely on; the AI drafts and varies, it does not certify truth.
Responsible AI / Ethics Note	No personal or confidential data is uploaded; locally relevant environmental data is supplied by the team; the tool’s footprint is weighed against the 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
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. Completeness of the verification log: every claim traced to a named source.
Evidence to Be Collected	☒ Resource pack ☒ Verification log ☒ Screenshot of AI interaction ☒ 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 generated claim failed verification, and how did you catch it? 2. What did content adaptation add? 3. Where would a non-AI strategy have been better?

6. Application Notes

Teacher Preparation	Review Subtopic 5.2; prepare a green-STEM topic and a short list of authoritative sources for verification.
Time Schedule	Prompt demo: 10 min Production & verification: 30 min Peer review: 15 min Reflection: 5 min.
Accessibility / Inclusion	Allow work in the most proficient language; provide the authoritative sources in advance.
Potential Risks	Unverified facts entering the pack; over-reliance on AI for creative parts; biased examples.
Precautions / Contingency Plan	Mandate the verification log; provide a licensed diagram as a fallback for the visual.

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	Choose the green-STEM topic and pin two authoritative sources; confirm tool access for all students.	Source list handed out
2. Demonstrate	Enter one prompt live, then show one factual claim being checked against a source; capture a screenshot of both screens.	Screenshot: prompt and verification
3. Run	Students work in pairs, keeping a verification log with one row per claim: claim, source, verdict.	Verification log
4. Review	Pairs exchange packs and mark any claim that cannot be traced to a source.	Peer-feedback form
5. Close	Each student states where the tool advanced their learning and completes the AI Usage Log.	Appropriateness note and AI Usage Log

Joint Completion Checklist

No.	Checkpoint	Completed
1	A pedagogically rich prompt (audience, outcome, misconceptions) is written.	☐
2	Level and/or language variants are generated.	☐
3	Every fact, formula and reference is verified against a source.	☐
4	Examples and language are checked for bias and inclusivity.	☐



5	Each artefact is aligned to a stated outcome.	☐
6	Creative/assessed tasks are not outsourced to AI.	☐
7	No personal or confidential data was entered into public tools.	☐
8	A verification log documents the checks.	☐



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