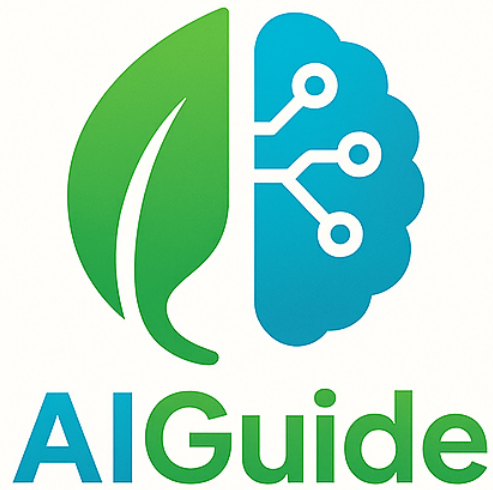




ONLINE COURSE CONTENT

MODULE 3: SECTOR-SPECIFIC AND DISCIPLINE-SPECIFIC APPLICATIONS

2025-1-LT01-KA220-HED-000354784

Artificial Intelligence for Green Understanding, Insights & Decision Empowerment



Co-funded by
the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the National Agency of Erasmus+ Programme in Lithuania – Education Exchanges Support Foundation (ŠMPF). Neither the European Union nor the ŠMPF can be held responsible for them.

Table of Contents

A. General Information	2
B. Content for STEM Higher Education Faculty.....	3
Highlights.....	3
Introduction.....	3
Green Decision-Making Context	4
C. Classroom Scenarios	5
Classroom Scenario 1 – Built Environment and Construction Infrastructure.....	5
Classroom Scenario 2 – Energy and Electrical Systems	5
Classroom Scenario 3 – Sustainable Transportation and Mobility	6
Classroom Scenario 4 – Manufacturing, Materials, and Product Design.....	6
Classroom Scenario 5 – Agriculture, Food, and Biosystems.....	7
Classroom Scenario 6 – Natural and Environmental Sciences	7
D. Activity Cards	8
Activity Card M3.7-A1 – Net-Zero Retrofit Presentation.....	8
Activity Card M3.7-A2 – Regional Renewable Energy Systems	11
Activity Card M3.7-A3 – Low-Carbon Urban Mobility	14
Activity Card M3.7-A4 – Biomimetic Sustainable Product Design.....	17
Activity Card M3.7-A5 – Agricultural Practice Decision.....	20
Activity Card M3.7-A6 – Urban Heat Mitigation	23
Recommended Reading.....	25



A. General Information

Module No.	Module 1 Module 2 Module 3 Module 4 Module 5
Subtopic	3.7 - Sector- and Discipline-Specific Applications
AI literacy component	Interpreting discipline-specific evidence and tool suitability; adapting AI support to the context of professional decision-making (cf. UNESCO, Miao & Shiohira 2024)
Decision-Making Skills	Contextual decision-making; comparing alternatives against disciplinary criteria; managing uncertainty and constraints; making reasoned decisions
Learning Objective for STEM Higher Education Faculty	Adapt AI-supported green decision-making activities to discipline-specific professional contexts by identifying the decision object, relevant evidence, discipline criteria, the role of AI support, and human responsibility.
Learning Objective for STEM Students	Applies AI-supported green decision-making to a discipline-specific problem and justifies a decision made under human responsibility, citing relevant evidence, constraints, and sustainability criteria.
Recommended AI Tools	Chatbots, research discovery tools, open data dashboards, and AI-supported presentation/writing tools introduced in the AIGUIDE WP2-A3 Best Practices Report, which are free or available for basic use during class. The choice of tools is up to the student or teacher.
Estimated Duration	A 60-minute faculty development session; plus six independent student activities, each requiring 90 minutes plus optional preparation time

B. Content for STEM Higher Education Faculty

Highlights

- While green decision-making is a common approach, the subject of the decision, the evidence, and professional constraints may vary by discipline.
- This section brings sustainability awareness and an evidence-based approach to green decision-making into the disciplinary context.
- Artificial Intelligence(AI)I provides support during the stages of evidence search, data organization, comparison, and presentation of alternatives. The final decision, verification, and professional responsibility remain with humans.
- Students justify their choice of tool based on task suitability, free/basic access, accessibility, and tool limitations.
- It includes six independent activity cards that instructors can select and implement according to their own discipline.

Introduction

Green decision-making in STEM (Science, Technology, Engineering, and Mathematics) fields such as engineering, energy, transportation, manufacturing, agriculture, environmental sciences, and mathematical modeling shares the same fundamental approach. This involves understanding environmental impacts, obtaining evidence to support decisions, and explaining the rationale for the decision in a verifiable manner.



Co-funded by
the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the National Agency of Erasmus+ Programme in Lithuania – Education Exchanges Support Foundation (ŠMPF). Neither the European Union nor the ŠMPF can be held responsible for them.

However, selecting a building reinforcement method, for example, is not evaluated using the same type of evidence or professional approach as selecting a renewable energy source, a specific agricultural practice, or an optimization model. Discipline-specificity involves appropriately defining the method of validation, acceptance criteria, and boundaries of responsibility.

Green Decision-Making Context

Common AI-Supported Green Decision-Making Workflow

Faculty members from different disciplines can apply the evidence-based decision-making cycle in a discipline-specific manner using the following 5E workflow (Bybee et al. 2006).

Stage	Key Question	Appropriate AI support	Human Responsibility
Engage	What professional decision will be made, and what are its limits?	Analyse the problem, identify gaps	Clarify the scope of the decision and its environmental objective
Explore	a. What data, standards, and sources are needed? b. What are the criteria and constraints of the problem?	a. Literature review, data organization, proposing variables b. Identifying criteria and constraints by reviewing standards, regulations, and policy documents	a. Verifying sources; evaluating data quality b. Determining the suitability of relevant criteria and constraints for the problem
Explain	How do the proposed decisions lead to outcomes under the criteria and constraints?	Creating a comparison table, scenarios, and counterarguments	Identifying assumptions and arguments
Elaborate	Which option is professionally defensible?	Drafting the decision and providing communication support (voting, obtaining decision approval, etc.)	Making the final selection and reporting the rationale
Evaluate	Which outcomes were validated, rejected, or remained uncertain?	Checking for inconsistencies and missing evidence	Clarifying the Boundaries and Uncertainties of a Decision

Tool Selection and Responsible Use

Students or faculty members may select a tool suitable for the task from those introduced in the AIGUIDE WP2-A3 Best Practices Report and accessible during class, or a tool they are proficient in using. For tool access, the faculty member verifies free/basic access and terms of use prior to class.

- Task suitability: Does the tool support tasks such as evidence search, data interpretation, comparison, or communication?
- Access and inclusivity: Can all students access the same basic functions; are there any additional device or infrastructure requirements?
- Privacy: Is personal, institutional, commercial, or unpublished data being transferred to an external system?
- Traceability: Can students trace a claim in the AI output back to its original source or dataset?
- Limitations: How can risks such as hallucination, outdated information, lack of context, bias, or over-reliance be mitigated?



- Contingency plan: If the AI tool fails, is there a prepared output, a printed case package, or an AI-free analysis method available?

Students select an accessible AI tool introduced in the AIGUIDE WP2-A3 Best Practices Report, taking into account task suitability, free/basic access, accessibility, privacy, and tool limitations. AI supports decision-making; it does not make the final decision.

C. Classroom Scenarios

The examples in this section are adapted from the classroom scenarios in the AIGUIDE WP2-A3 Best Practices Report (2026). Each example is linked to the corresponding activity card in the following section.

Classroom Scenario 1 – Built Environment and Construction Infrastructure

Example for the fields of architecture; civil engineering; energy engineering; and construction management:

In the built environment, a discipline-specific decision involves implementing the most appropriate option among those that promote energy savings. When making this decision, criteria such as the intervention's operational energy impact, embodied carbon, cost, user impact, technical feasibility, and remaining building lifespan are evaluated collectively. The Intergovernmental Panel on Climate Change (IPCC, 2022), in its “Buildings” chapter, emphasizes that building-scale mitigation must be addressed in conjunction with energy efficiency, low-carbon energy, and a life-cycle approach. The Global Status Report for Buildings and Construction likewise demonstrates that performance should not be limited to operational energy alone (United Nations Environment Programme [UNEP] & Global Alliance for Buildings and Construction [GlobalABC], 2025).

Decision Point	The retrofit approach to be applied to a specific campus or public building
Evidence and criteria	Energy intensity; estimated energy/carbon reduction; embodied carbon; life-cycle cost; maintenance; user impact; relevant regulations
AI support	Identifying alternatives, questioning assumptions, comparison table, and draft customer presentation
Human responsibility	Verifying technical values and regulatory compliance; assuming responsibility for the decision's safety and feasibility
Professional output	Retrofit decision matrix and a proposal presentation
Related Activity Card: M3.7-A1 “Net-Zero Retrofit Presentation”	

Classroom Scenario 2 – Energy and Electrical Systems

Example for the fields of electrical and electronic engineering; energy systems; renewable energy; and power systems:

When attempting to reduce the average carbon footprint of a technology in energy systems applications, criteria such as resources, capacity, supply-demand matching, grid connection, flexibility/storage needs, land use, and local feasibility are considered together. The International Energy Agency (IEA, 2024)



emphasizes the importance of grid flexibility and integration measures to safely incorporate rapidly growing solar and wind capacity into the system. The IPCC evaluates energy systems in conjunction with their physical and social components (IPCC, 2022).

Decision Point	Prioritising a wind, solar, or hybrid renewable energy system for a specific region
Evidence and criteria	Source data; hourly/seasonal profile; demand matching; grid capacity; flexibility; life-cycle emissions; cost; land and community impacts
AI support	Explaining data patterns, comparing scenario assumptions, and generating counterarguments
Human responsibility	Verifying technical data from the original source; evaluating grid reliability and design constraints
Professional output	Renewable energy system summary report and comparative performance chart
Related Activity Card: M3.7-A2 “Regional Renewable Energy System”	

Classroom Scenario 3 – Sustainable Transportation and Mobility

Example for the fields of transportation engineering, urban and regional planning, and logistics:

In transportation decisions, criteria such as vehicle technology (including the adoption of electric vehicles), demand, accessibility, mode choice, infrastructure, safety, and access for different user groups should be evaluated together. The IPCC (2022) recommends examining system interactions and life-cycle impacts in its “Transportation” chapter. The International Transport Forum (ITF, 2023) addresses emissions reduction in conjunction with decisions on more livable cities and infrastructure.

Decision Point	A package of low-carbon transportation interventions for an urban area
Evidence and criteria	Trip demand; emissions; travel time; safety; capacity; cost; feasibility; accessibility
AI support	Grouping intervention options, identifying data gaps, developing counterarguments from different perspectives
Human responsibility	Verifying local data and interpretations; assessing safety, accessibility, and infrastructure constraints
Professional output	An annotated mobility intervention and prioritization recommendation
Related Activity Card: M3.7-A3 “Low-Carbon Urban Mobility”	

Classroom Scenario 4 – Manufacturing, Materials, and Product Design

Example for the fields of product design; materials engineering; industrial design; manufacturing engineering; and bioengineering:

Claims of innovation in product and material selection must be tested against verified functionality and life cycle impacts. The fact that a biomimetic principle is intriguing does not necessarily mean it is manufacturable or environmentally superior. Resource/energy inputs, strength, durability, toxicity, reparability, production scale, service life, and end-of-life are evaluated collectively. ISO 14040 and 14044 define the stages of purpose and scope, inventory, impact assessment, and interpretation in life cycle



assessment (International Organization for Standardization [ISO], 2006a, 2006b). The Global Resources Outlook links rising resource use to growing environmental impacts and underlines the need for resource-efficient design and material choices (United Nations Environment Programme, International Resource Panel, 2024).

Decision Point	Which biomimetic principle and material approach for a product problem should be advanced to the concept development phase?
Evidence and criteria	Scientific basis; functional alignment; manufacturability; material/energy input; strength; durability; toxicity; reparability; circularity; scalability
AI support	Literature review, concept clusters, research gaps, and distinction between claims and assumptions
Human responsibility	Verify sources against the full text; do not interpret graphics as scientific evidence; limit design claims
Professional output	Verified research map and sustainable product concept
Related Activity Card: M3.7-A4 “Biomimetic Sustainable Product Design”	

Classroom Scenario 5 – Agriculture, Food, and Biosystems

Example in the fields of agricultural engineering; food engineering; biology; environmental engineering: Decisions made to select an applicable agricultural intervention have a synergistic effect in the areas of productivity, soil, water, biodiversity, and climate resilience. The Food and Agriculture Organization (FAO, 2013) defines climate-smart agriculture as an approach that addresses productivity, adaptation, and mitigation goals together within a local context. The Nexus Assessment of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) demonstrates that decisions regarding biodiversity, water, and food cannot be optimised in isolation (IPBES, 2024).

Decision Point	An intervention package for a specific farm or basin consisting of components such as nutrient management, buffer strips, cover crops, irrigation, integrated pest management or animal husbandry practices
Evidence and Criteria	Yield; water use; nitrate/phosphorus loss; soil health; biodiversity; input costs; labor; climate risk; farmer feasibility
AI support	Visualising interactions, generating alternative scenarios, and identifying questions regarding missing data
Human responsibility	Verifying local data; testing generalized AI recommendations against local soil, crop, and climate conditions
Professional output	Agricultural intervention matrix and farm/basin recommendations
Related Activity Card: M3.7-A5 “Agricultural Practice Decision”	

Classroom Scenario 6 – Natural and Environmental Sciences

An applicable example in the fields of environmental science, ecology, climate science, geography, and environmental engineering:



Co-funded by
the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the National Agency of Erasmus+ Programme in Lithuania – Education Exchanges Support Foundation (ŠMPF). Neither the European Union nor the ŠMPF can be held responsible for them.

In environmental science, decisions are based on measured variables and local and ecological feasibility. Interventions such as tree planting, green roofs, cool roofs/surfaces, and shading for urban heat reduction operate at different spatial scales and have varying effects. The IPCC (2022) emphasizes the interactions among land use, the built environment, energy, and transportation in urban systems.

Decision Point	A package of urban heat mitigation interventions to be implemented in a densely populated area
Evidence and criteria	Air/surface temperature; exposure; shade/vegetation cover; water and maintenance requirements; biodiversity benefits; feasibility
AI support	Literature review, comparison table, identification of variables and evidence gaps
Human responsibility	Understanding original studies; assessing effect size; confirming feasibility
Professional output	Evidence comparison table and brief report on environmental interventions
Related Activity Card: M3.7-A6 “Urban Heat Mitigation”	

D. Activity Cards

The following six cards constitute an independent activity bank based on the classroom scenarios given above. The instructor selects an activity card appropriate for their discipline. The cards use a common structure and assessment protocol and a 90-minute flow.

Activity Card M3.7-A1 – Net-Zero Retrofit Presentation

Activity Summary: Teams compare three retrofit pathways for their campus building and present a validated, AI-supported proposal.

1. Activity Description

Module / Unit	Module 3 - Subtopic 3.7: Sector- and Discipline-Specific Applications
Relevant Decision Context	Real-Life Example 1 – Built Environment and Construction Infrastructure
Activity Code	M3.7-A1
Activity Title	Net-Zero Retrofit Presentation
Developing Partner	EDUJI
Recommended Duration	90 minutes + optional preparation
Delivery Format	In-class Synchronous online Asynchronous online Blended
Student grouping	Individual Pairs Small groups of 3–4 Whole class
STEM context/discipline	Architecture; civil engineering; energy engineering; construction and building management



2. Pedagogical Design

Learning Objectives	1. Compares retrofit alternatives based on given criteria such as energy, carbon emissions and cost. 2. Verifies technical constraints and limits with AI outputs and sources. 3. Develops a proposal that highlights technical constraints and emphasises human responsibility.
AI Literacy Objectives	Understanding AI concepts Critically using AI tools Evaluating AI outputs Human-AI decision-making Ethical/responsible use
Green Decision Focus	Climate change Energy Materials/resources Biodiversity Water Other: built environment
Prerequisite Knowledge	Subtopic 3.1: Sustainability indicators; Subtopic 3.2: Evidence-based justification; basic knowledge of building energy and life cycles.
Key Concepts	retrofit; energy use; operational / embodied carbon; life cycle cost; technical feasibility

3. Design of the Student Assignment

Student Scenario / Problem	The university administrators want to retrofit a given campus building with a net-zero goal. Examine the building type, year of construction, building envelope, HVAC (Heating, Ventilation, and Air Conditioning) system, insulation system, etc. There are three options: (A) building envelope improvements, (B) HVAC system retrofit, (C) a combination of A and B. Your team will analyse data on energy performance, embodied carbon, cost, and maintenance to determine which option to recommend.
Student Guidelines	1. Define the problem (10 min): Describe the building type, constraints, and decision criteria. 2. Review the evidence (20 min): Using real building data or the prepared case study package, verify data quality and compare the three options. 3. Generate alternatives with AI (20 min): Ask your chosen tool to identify missing assumptions, additional data needs and verify each claim. 4. Present the decision matrix (25 min): Complete the weighted retrofit decision matrix and determine your recommendation. 5. Presentation and evaluation (15 min): Deliver the presentation and submit the AI Usage Log.
Input materials and data sources	Preferred approach: real-campus building energy and maintenance data and their costs. Alternative approach: a prepared case package with three alternatives provided by the instructor; for each alternative, include energy savings, embodied carbon, cost index, and maintenance information.
Expected student output	Retrofit decision matrix + a recommendation presentation of up to 5 slides + AI Usage Log.

4. AI Use and Green Decision-Making

Recommended Tool Approach	Students will select a tool—introduced in the AIGUIDE WP2-A3 Best Practices Report and available for free/basic use during the course—based on task suitability, accessibility, privacy, and limitations. No paid features are required. Example tool families: free/basic chatbot; accessible AI-powered presentation tool; spreadsheet and open building/climate data sources.
Sample prompts/interaction guide	• “Before deciding on one of these three retrofit options, review them solely for incomplete assumptions and comparability issues.” • “Come up with three technically compelling counterarguments for Option B; specify the data that needs to be verified for each one.” • “Which claims in our recommendation presentation require additional sources or calculations?”
Critical evaluation requirements	accuracy bias source quality uncertainty environmental suitability ethical/stakeholder impacts



Human decision-making component	The final retrofit option recommendation, criterion weightings, regulatory compliance, presentation.
AI accountability/ethics note	If real building data is used, user/operational data is anonymised. AI claims regarding cost, energy, or regulatory compliance are verified using original data and standards.
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 team's final decision?

5. Evaluation and Evidence

Evaluation Method	Checklist Graded rubric Peer feedback Teacher feedback Self-assessment
Common evaluation 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. Comparison of operational and embodied carbon within the same system boundary and over the same time period.
Evidence to be collected	Student output; decision matrix; source and data; AI Usage Log
Success indicator	Sufficient performance on at least five of the six evaluation criteria supported by evidence-based justification.
Feedback questions	Which evidence most influenced the decision? Which AI output did you correct or reject, and why? What new data could change your decision?

6. Implementation Notes

Teacher Preparation	Prepare the three retrofit alternatives, the database, and the decision matrix template; test tool access.
Time Schedule	Problem definition: 10 min Evidence/data review: 20 min AI-assisted inquiry and verification: 20 min Decision/output development: 25 min Sharing and AI Usage Log: 15 min
Accessibility and Inclusion	Provide materials in an editable and screen-reader-compatible format; rotate the roles of data analyst, AI operator, skeptic/verifier, and reporter within the group
Potential risks	Comparison of different system limits; AI generating fictitious savings/cost values.
Mitigation / Contingency Plan	Provide a printed case, a pre-prepared sample AI response, and a spreadsheet template.
Extension / Follow-up	Design monitoring and verification indicators for the selected option; link to Subtopic 3.4 for feasibility.



Activity Card M3.7-A2 – Regional Renewable Energy Systems

Activity Summary: Teams compare wind, solar, and hybrid energy system options using local resource and grid data.

1. Activity Description

Module / Unit	Module 3 - Subtopic 3.7: Sector- and Discipline-Specific Applications
Relevant Decision Context	Real-Life Example 2 – Energy and Electrical Systems
Activity Code	M3.7-A2
Activity Title	Regional Renewable Energy
Developing Partner	EDUJI
Recommended Duration	90 minutes + optional preparation
Delivery Format	In-class Synchronous online Asynchronous online Blended
Student grouping	Individual Pairs Small groups of 3–4 Whole class
STEM context / discipline	Electrical and electronic engineering; energy systems; renewable energy;

2. Pedagogical Design

Learning Objectives	1. Evaluates renewable energy options by considering the supply-demand balance and grid constraints. 2. Tests AI's explanations of energy systems using data and calculations. 3. Develops a technical proposal that highlights uncertainties and integration necessities.
AI Literacy Objectives	Understanding AI concepts Critically using AI tools Evaluating AI outputs Human-AI decision-making Ethical/responsible use
Green Decision Focus	Climate change Energy Materials/resources Biodiversity Water Other: grid integration
Prerequisite Knowledge	Subtopics 3.1–3.2; basic concepts of power and energy; generation, energy demand.
Key Concepts	wind; solar; hybrid; demand matching; grid constraint

3. Design of the Student Assignment

Student Scenario / Problem	The energy planning unit in your region is evaluating three options for new renewable capacity: (A) solar-dominated, (B) wind-dominated, (C) a mixed wind-solar system. Your team will decide which system should be prioritised by evaluating local resources, hourly/seasonal demand, capacity, cost, and environmental constraints.
Student Guidelines	1. Define the problem and its constraints (10 min): Identify the energy target, time horizon, and constraints. 2. Analyse the data (20 min): Visualise the resource and demand profiles; flag missing and incomparable data. 3. Conduct a validation test with AI (20 min): Ask the tool you selected to explain the energy systems' weaknesses and any need for additional data; verify technical claims. 4. Decide the energy system (25 min): Make a selection based on the performance table and justified weightings. 5. Share and save (15 min): Present the technical summary report and complete the AI Usage Log.



Input materials and data sources	Raw source data, regional load profile, and grid information for the three systems.
Expected student output	Renewable energy systems summary report + comparative performance chart + AI Usage Log.

4. AI Use and Green Decision-Making

Recommended Tool Approach	Students will select a tool—introduced in the AIGUIDE WP2-A3 Best Practices Report and available for free/basic use during the course—based on task suitability, accessibility, privacy, and limitations. No paid features are required. Example tool families: free/basic chatbot; open energy/data dashboard; spreadsheet or accessible data visualisation tool.
Sample prompts/interaction guide	• “Before selection, list the critical variables that affect the supply-demand balance.” • “Explain the advantages and risks of a mixed system in terms of grid flexibility, and the data that needs to be verified.” • “Under which assumption can the analysis be reversed?”
Critical evaluation requirements	accuracy bias data quality uncertainty environmental suitability ethical/stakeholder impacts
Human decision-making component	Energy system selection, constraints, and grid suitability are determined and verified by the students.
AI accountability/ethics note	Impacts on the local community, land, and ecosystems are highlighted as a separate evaluation criterion distinct from technical performance
AI Usage Log	A brief, four-part record: (1) How did AI contribute? (2) Which outputs were independently verified? (3) Which outputs were corrected / rejected? (4) What is the team’s final decision?

5. Evaluation and Evidence

Evaluation Method	Checklist Graded rubric Peer feedback Teacher feedback Self-assessment
Common evaluation 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. Alignment of the generation profile with demand and grid connection constraints.
Evidence to be collected	Student output; decision matrix; source and data; AI Usage Log; brief peer feedback.
Success indicator	Sufficient performance on at least five of the six criteria; no failure in the final decision criteria under human responsibility, supported by evidence-based justification.
Feedback questions	Which evidence most influenced the decision? Which AI output did you correct or reject, and why? What new data could change your decision?

6. Implementation Notes

Teacher Preparation	Prepare the three energy system datasets and the hourly/seasonal graph template; check that the units and data periods are consistent.
Time Schedule	Problem definition: 10 min Evidence/data review: 20 min AI-based inquiry and verification: 20 min Decision/output development: 25 min Sharing and AI Usage Log: 15 min
Accessibility and Inclusion	Provide materials in an editable and screen-reader-compatible format; rotate the roles of data analyst, AI operator, skeptic/verifier, and reporter within the group
Potential risks	Focusing solely on annual total energy; AI providing outdated cost or capacity values.



Mitigation / Contingency Plan	Provide pre-drawn supply-and-demand graphs and a printed data table
Extension / Follow-up	Add a storage or demand-side flexibility option for the selected energy system and re-evaluate the results.



Activity Card M3.7-A3 – Low-Carbon Urban Mobility

Activity Summary: Teams select an intervention package for an urban area that balances emissions, accessibility, safety, and feasibility.

1. Activity Description

Module / Unit	Module 3 - Subtopic 3.7: Sector- and Discipline-Specific Applications
Relevant Decision Context	Real-Life Example 3 – Sustainable Transportation and Mobility
Activity Code	M3.7-A3
Activity Title	Low-Carbon Urban Mobility
Developing Partner	EDUJI
Recommended Duration	90 minutes + optional preparation
Delivery Format	In-class Synchronous online Asynchronous online Blended
Student grouping	Individual Pairs Small groups of 3–4 Whole class
STEM context/discipline	Transportation engineering; urban and regional planning; logistics

2. Pedagogical Design

Learning Objectives	1. Compares transportation interventions with their system-level impacts on demand, access, and emissions. 2. Identifies gaps in maps and open data with AI support. 3. Develops a prioritisation proposal that addresses access and safety for different users.
AI Literacy Objectives	Understanding AI concepts Critically using AI tools Evaluating AI outputs Human-AI decision-making Ethical/responsible use
Green Decision Focus	Climate change Energy Materials/resources Biodiversity Water Other: accessible mobility
Prerequisite Knowledge	Subtopics 3.1–3.2; basic concepts of transportation demand, mode share, and emissions; Subtopic 3.5: stakeholder impact assessment.
Key Concepts	modal share; accessibility; travel demand; emissions; active transportation; public transit; electric vehicles; demand management; road safety

3. Design of the Student Assignment

Student Scenario / Problem	Your local city officials aim to reduce transportation-related emissions and improve accessibility in a densely populated area. Components to be evaluated include improvements to public transportation, a cycling and pedestrian network, parking and demand management, transit connections, electric vehicle (EV) and fleet electrification. Your team will propose a data-driven and feasible intervention.
Student Guidelines	1. Define the area and its users (10 min): Identify the decision boundaries. 2. Review the map and data (20 min): Highlight evidence related to demand, emissions, travel time, and accessibility. 3. Conduct a gap analysis using AI (20 min): Identify overlooked user groups, unintended impacts, and additional data needs; validate the results. 4. Select an intervention package (25 min): Prioritise interventions and justify them. 5. Peer review (15 min):



Co-funded by
the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the National Agency of Erasmus+ Programme in Lithuania – Education Exchanges Support Foundation (ŠMPF). Neither the European Union nor the ŠMPF can be held responsible for them.

	Another team reviews the proposal in terms of safety, access, and emissions; the AI Usage Log is completed.
Input materials and data sources	Preferred source: municipal transportation reports, open-access map/emissions data (if it exists). Alternative source: a regional map and a case package containing scores for the three intervention components—emissions, capacity, cost, access, safety, and implementation time.
Expected student output	A mobility intervention solution and priority recommendations + AI Usage Log.

4. AI Use and Green Decision-Making

Recommended Tool Approach	Students will select a tool—introduced in the AIGUIDE WP2-A3 Best Practices Report and available for free/basic use during the course—based on task suitability, accessibility, privacy, and limitations. No paid features are required. Example tool categories: free/basic chatbot; open municipal/data dashboard; map.
Sample prompts/interaction guide	• “Which data or user groups are easily overlooked in this transportation decision?” • “Identify three unintended consequences of the proposed public transportation option and specify the data needed to test them.” • “How might our priority ranking on the map change if the accessibility criterion were given double the weight?”
Critical evaluation requirements	accuracy bias data quality uncertainty environmental suitability ethical/stakeholder impacts
Human decision-making component	The intervention package, prioritisation, interpretation, and accessibility are the responsibility of the student team.
AI accountability/ethics note	If mobility data contains personal or location data, it is used only in an anonymous and aggregated form.
AI Usage Log	Four-part brief record: (1) How did AI contribute? (2) Which findings were independently verified? (3) Which findings were corrected or rejected? (4) What is the team’s final decision?

5. Evaluation and Evidence

Evaluation Method	Checklist Graded rubric Peer feedback Teacher feedback Self-assessment
Common evaluation criteria	1. Disciplinary accuracy; 2. Evidence-based reasoning; 3. Critical and transparent use of AI; 4. Sustainability impacts; 5. Clear and human-driven final decision; 6. Addressing accessibility and network connectivity alongside emissions reduction
Evidence to be collected	Student output; decision matrix; source and data; AI Usage Log; brief peer feedback.
Success indicator	Sufficient performance on at least five of the six criteria; final decision supported by evidence-based justification.
Feedback questions	Which evidence most influenced the decision? Which AI output did you correct or reject, and why? What new data could change your decision?

6. Implementation Notes

Teacher Preparation	Prepare the regional map, dataset, and intervention cards
Time Schedule	Problem definition: 10 min Evidence/data review: 20 min AI-based inquiry and verification: 20 min Decision/output development: 25 min Sharing and AI Usage Log: 15 min



Accessibility and Inclusion	Provide materials in an editable and screen-reader-compatible format; rotate the roles of data analyst, AI operator, skeptic/verifier, and reporter within the group
Potential risks	Focusing solely on technology/tool changes; use of personal mobility data.
Mitigation / Contingency Plan	Provide a printed map, a prepared data table, and a pre-generated AI gap analysis.
Extension / Follow-up	Assess the organisational feasibility and risks within the framework of Subtopic 3.4.



Activity Card M3.7-A4 – Biomimetic Sustainable Product Design

Activity Summary: Teams map the research data using verified sources and select the biomimetic approach for a sustainable product design.

1. Activity Description

Module / Unit	Module 3 – Subtopic 3.7: Sector- and Discipline-Specific Applications
Relevant Decision Context	Real-Life Example 4 – Manufacturing, Materials, and Product Design
Activity Code	M3.7-A4
Activity Title	Biomimetic Sustainable Product Design
Developing Partner	EDUJI
Recommended Duration	90 minutes + optional preparation
Delivery Format	In-class Synchronous online Asynchronous online Blended
Student grouping	Individual Pairs Small groups of 3–4 Whole class
STEM context/discipline	Materials engineering; industrial design; manufacturing engineering; bioengineering

2. Pedagogical Design

Learning Objectives	1. Validates the output of the literature review in terms of scientific quality and design appropriateness. 2. Understands the biomimetic approach with regard to product requirements and life cycle criteria. 3. Decides on a biomimetic product design concept with defined claims that is manufacturable.
AI Literacy Objectives	Understanding AI concepts Critically using AI tools Evaluating AI outputs Human-AI decision-making Ethical/responsible use
Green Decision Focus	Climate change Energy Materials/resources Biodiversity Water Other: circular design
Prerequisite Knowledge	Subtopics 3.1–3.2; materials/manufacturing or product design; literature search, and life cycle thinking.
Key Concepts	biomimicry; literature research; manufacturability; life cycle; circularity

3. Design of the Student Assignment

Student Scenario / Problem	A design team aims to develop a new product feature that will reduce material and energy use. Teams will map biomimetic strategies and relevant material/design research for a selected problem; they will then advance only one of three candidate approaches to the concept development phase.
Student Guidelines	1. Define the product problem (10 min): Clearly state the desired functionality and sustainability goal. 2. Analyse the research findings (20 min): Using state-of-the-art reports and articles, distinguish between foundational and opposing studies. 3. Review the AI/discovery tool (20 min): Check whether the suggested links are supported by full-text sources; remove fabricated or overly generalised claims. 4. Make a design decision (25 min): Compare three biomimetic approaches based on function, manufacturability, and life



	cycle criteria, then select one. 5. Present the concept (15 min): Share the concept sheet and the AI Usage Log.
Input materials and data sources	Preferred path: scientific publications, material data sheets, and product requirements. Alternative path: a curated reading package of 8–10 sources and three biomimetic approach cards.
Expected student output	Verified research map + sustainable product concept sheet + AI Usage Log.

4. AI Use and Green Decision-Making

Recommended Tool Approach	Students select a tool—introduced in the AIGUIDE WP2-A3 Best Practices Report and available for free/basic use during the course—based on task suitability, accessibility, privacy, and limitations. No paid features are required. Example tools: Accessible basic versions of ResearchRabbit, Connected Papers, Elicit, or Consensus; a free/basic chatbot.
Sample prompts/interaction guide	• “Which assumptions should be tested when translating this biomimetic approach into a product design?” • “Generate check questions to categorise the claims in this list of sources as strong evidence, limited evidence, and speculation.” • “Identify three ways in which our chosen approach could fail in terms of manufacturability and end-of-life considerations.”
Critical evaluation requirements	accuracy bias source quality uncertainty environmental suitability ethical/stakeholder impacts
Human decision-making component	The decision regarding source selection, scientific quality, the translation of biomimetic approach into design, and concept development rests with the student team.
AI accountability/ethics note	AI summary does not constitute scientific quality. Misrepresentation of resources and the assumption that “what is natural is sustainable” are subject to discussion.
AI Usage Log	A brief, four-part record: (1) How did AI contribute? (2) Which outputs were independently verified? (3) Which outputs were corrected or rejected? (4) What is the team’s final decision?

5. Evaluation and Evidence

Evaluation Method	Checklist Graded rubric Peer feedback Teacher feedback Self-assessment
Common evaluation 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. Choice of proper biomimetic approach to product requirements, sustainability and manufacturability limits.
Evidence to be collected	Student output; decision matrix; source and data; AI Usage Log; brief peer feedback.
Success indicator	Sufficient performance on at least five of the six criteria; final decision supported by evidence-based justification.
Feedback questions	Which evidence most influenced the decision? Which AI output did you correct or reject, and why? What new data could change your decision?

6. Implementation Notes

Teacher Preparation	Prepare the product problem, resource package, and concept sheet template; provide a printed resource matrix as an alternative to research tools.
Time Schedule	Problem definition: 10 min Evidence/data review: 20 min AI-based inquiry and verification: 20 min Decision/output development: 25 min Sharing and AI Usage Log: 15 min



Accessibility and Inclusion	Provide materials in an editable and screen-reader-compatible format; rotate the roles of data analyst, AI operator, skeptic/verifier, and reporter within the group
Potential risks	Mistaking the research map for the final synthesis; generating concepts without verifying sources.
Mitigation / Contingency Plan	Provide printed resource summaries, a hand-drawn relationship matrix, and examples of unverified AI claims.
Extension / Follow-up	Create a simple life cycle, system boundary, and test plan for the selected concept.



Activity Card M3.7-A5 – Agricultural Practice Decision

Activity Summary: Teams select an agricultural intervention package that balances impacts on productivity, water quality, soil, and biodiversity.

1. Activity Description

Module / Unit	Module 3 - Subtopic 3.7: Sector- and Discipline-Specific Applications
Relevant Decision Context	Real-Life Example 5 – Agriculture, Food, and Biosystems
Activity Code	M3.7-A5
Activity Title	Agricultural Practice Decision
Developing Partner	EDUJI
Recommended Duration	90 minutes + optional preparation
Delivery Format	In-class Synchronous online Asynchronous online Blended
Student grouping	Individual Pairs Small groups of 3–4 Whole class
STEM context/discipline	Agricultural engineering; food engineering; animal science; biology; environmental engineering

2. Pedagogical Design

Learning Objectives	1. Compares the direct and indirect effects of agricultural interventions on production and the environment. 2. Tests AI's generalised recommendations against local data. 3. Develops a practical recommendation that includes monitoring indicators and uncertainties.
AI Literacy Objectives	Understanding AI concepts Critically using AI tools Evaluating AI outputs Human-AI decision-making Ethical/responsible use
Green Decision Focus	Climate change Energy Materials/resources Biodiversity Water Other: soil and food systems
Prerequisite Knowledge	Subtopics 3.1–3.2: basic knowledge of soil, water, crop production, or food systems; Subtopic 3.5: control of affected groups.
Key Concepts	nutrient management; crop; irrigation; animal husbandry; soil health; water quality; biodiversity; climate risk

3. Design of the Student Assignment

Student Scenario / Problem	As agricultural production continues in a basin or farm, water quality and habitat pressure are increasing. Teams will compare three intervention packages consisting of nutrient management, crops, irrigation improvements and animal husbandry management practices; they will select the package best suited to local conditions and propose monitoring indicators.
Student Guidelines	1. Define the system and the decision (10 min): Identify the crop/farm/basin boundary and the primary problem. 2. Review the evidence (20 min): Evaluate indicators for yield, water, soil, nutrient loss, and biodiversity. 3. Examine interactions with AI (20 min): Identify unintended effects, the need for local adaptation, and data gaps; validate the outputs with



	resources. 4. Select the package (25 min): Make a decision using the intervention matrix and justified weights; add a monitoring plan. 5. Sharing and evaluation (15 min): Another team assesses local applicability; the AI Usage Log is completed.
Input materials and data sources	Preferred pathway: open/local agriculture, soil, water, and climate data. Alternative pathway: a prepared case package containing indicators for yield, water use, nutrient loss, soil health, biodiversity and cost for the three intervention packages.
Expected student output	Agricultural intervention matrix + farm/basin recommendations and monitoring indicators + AI Usage Log.

4. AI Use and Green Decision-Making

Recommended tool approach	Students will select a tool—introduced in the AIGUIDE WP2-A3 Best Practices Report and available for free/basic use during the course—based on task suitability, accessibility, privacy, and limitations. No paid features are required. Example tool families: free/basic chatbot; open agriculture/climate/data dashboards; spreadsheet or simple system mapping tool.
Sample prompts/interaction guide	• “Identify three trade-offs this intervention package could create between yield, water quality, and biodiversity.” • “How can we transfer this recommendation to another soil or climate region?” • “What metrics should we collect to evaluate the decision?”
Critical evaluation requirements	accuracy bias source quality uncertainty environmental suitability ethical/stakeholder impacts
Human decision-making component	The selection of the intervention, local agronomic suitability, and monitoring plan are based on the student team’s validation.
AI accountability/ethics note	Farmer data, location, and farm information are protected. It is explicitly stated that AI cannot replace local knowledge, farmer experience, or ecosystem observation.
AI Usage Log	A brief, four-part record: (1) How did AI contribute? (2) Which outputs were independently verified? (3) Which outputs were corrected or rejected? (4) What is the team’s final decision?

5. Evaluation and Evidence

Evaluation Method	Checklist Graded rubric Peer feedback Teacher feedback Self-assessment
Common evaluation 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. Ability to monitor water quality, soil health, and biodiversity within the same decision-making framework.
Evidence to be collected	Student output; decision matrix; source and data trail; AI Usage Log; brief peer feedback.
Success indicator	Sufficient performance on at least five of the six criteria; final decision supported by evidence-based justification.
Feedback questions	Which evidence most influenced the decision? Which AI output did you correct or reject, and why? What new data could change your decision?

6. Implementation Notes

Teacher Preparation	Prepare the basin/farm boundaries and three intervention packages; include data for local conditions.
----------------------------	---



Time Schedule	Problem definition: 10 min Evidence/data review: 20 min AI-based inquiry and verification: 20 min Decision/output development: 25 min Sharing and AI Usage Log: 15 min
Accessibility and Inclusion	Provide materials in an editable and screen-reader-compatible format; rotate the roles of data analyst, AI operator, skeptic/verifier, and reporter within the group
Potential Risks	Using the general AI recommendation as if it were a local prescription; neglecting indicators other than efficiency.
Mitigation / Contingency Plan	Provide printed intervention cards, a prepared data table, and a sample AI Usage Log.
Extension / Follow-up	Compare the performance of the selected package under different climate scenarios; link to Subtopic 3.6 in the future for systemic connections.



Activity Card M3.7-A6 – Urban Heat Mitigation

Activity Summary: Teams compare urban heat mitigation efforts and propose an evidence-based intervention for a specific neighbourhood.

1. Activity Description

Module / Unit	Module 3 – Subtopic 3.7: Sector- and Discipline-Specific Applications
Relevant Decision Context	Real-Life Example 6 – Natural and Environmental Sciences
Activity Code	M3.7-A6
Activity Title	Urban Heat Mitigation
Developing Partner	EDUJI
Recommended Duration	90 minutes + optional preparation
Delivery Format	In-class Synchronous online Asynchronous online Blended
Student grouping	Individual Pairs Small groups of 3–4 Whole class
STEM context/discipline	Environmental science; ecology; climate science; geography; environmental engineering

2. Pedagogical Design

Learning Objectives	1. Evaluates the comparability of environmental studies in terms of measurement, scale, and context. 2. Verifies an AI-supported literature summary using original sources. 3. Develops an intervention proposal that incorporates impacts.
AI Literacy Objectives	Understanding AI concepts Critically using AI tools Evaluating AI outputs Human-AI decision-making Ethical/responsible use
Green Decision Focus	Climate change Energy Materials/resources Biodiversity Water Other: heat exposure
Prerequisite Knowledge	Subtopics 3.1–3.2; basic knowledge of environmental indicators, research methods, and resource assessment.
Key Concepts	urban heat island; air temperature; surface temperature; heat exposure; tree planting; green/cool roof;

3. Design of the Student Assignment

Student Scenario / Problem	Summer temperatures and heat exposure are increasing in a densely populated neighbourhood. Teams will compare the scientific evidence regarding shading, green roofs, cool roof surfaces, and small green spaces; they will recommend a priority intervention based on local ecological conditions.
Student Guidelines	1. Define the decision and metric (10 min): Which metrics will you consider? Examples are air temperature, surface temperature, heat exposure, and energy demand. 2. Compare the evidence (20 min): Evaluate actual publications or prepared study summaries based on design, scale, climate, and impact criteria. 3. Review the AI summary (20 min): Verify the comparison made by your chosen research tool against original sources; discard any overgeneralizations. 4. Select an intervention (25 min): Make a decision based on impact,



Co-funded by
the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the National Agency of Erasmus+ Programme in Lithuania – Education Exchanges Support Foundation (ŠMPF). Neither the European Union nor the ŠMPF can be held responsible for them.

	maintenance, water, and biodiversity criteria. 5. Short report and peer review (15 min): Share the evidence table and complete the AI Usage Log.
Input materials and data pathways	Preferred approach: local heat/green space maps, open-access meteorological data, and verifiable scientific publications. Alternative approach: a neighbourhood map based on 6–8 study abstracts; for each study, include climate, sample, measured indicator, direction of effect, and limitations.
Expected student output	Evidence comparison table + brief report on environmental interventions + AI Usage Log.

4. AI Use and Green Decision-Making

Recommended Tool Approach	Students select a tool—introduced in the AIGUIDE WP2-A3 Best Practices Report and available for free/basic use during the course—based on task suitability, accessibility, privacy, and limitations. No paid features are required. Example tool families: Accessible basic versions of Elicit, Consensus, ResearchRabbit, or Connected Papers; a free/basic chatbot; an open environmental data dashboard.
Sample prompts/interaction guide	• “List the differences in design and scale that prevent a direct comparison of the results of these studies.” • “What are the drawbacks of equating a decrease in surface temperature with a decrease in human heat exposure?” • “What might be the side effects of the proposed intervention in terms of water use, maintenance, and biodiversity?”
Critical evaluation requirements	accuracy bias source quality uncertainty environmental suitability ethical/stakeholder impacts
Human decision-making component	Study quality, effect size, generalizability, and intervention decisions are evaluated by students based on original sources and local data.
AI accountability/ethics note	Heat exposure and sensitivity data are used in a way that does not identify small groups.
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 team’s final decision?

5. Evaluation and Evidence

Evaluation Method	Checklist Graded rubric Peer feedback Teacher feedback Self-assessment
Common evaluation 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. Decision claim that is consistent with the measured environmental indicator and the local context
Evidence to be collected	Student output; decision matrix; source and data; AI Usage Log; brief peer feedback.
Success indicator	Sufficient performance on at least five of the six criteria; final decision supported by evidence-based justification.
Feedback questions	Which evidence most influenced the decision? Which AI output did you correct or reject, and why? What new data could change your decision?

6. Implementation Notes

Teacher Preparation	Prepare the neighbourhood map, the activity evaluation form, and the resource package; provide printed summaries if the research tool does not work.
----------------------------	--



Time Schedule	Problem definition: 10 min Evidence/data review: 20 min AI-based inquiry and verification: 20 min Decision/output development: 25 min Sharing and AI Usage Log: 15 min
Accessibility and Inclusion	Provide materials in an editable and screen-reader-compatible format; rotate the roles of data analyst, AI operator, skeptic/verifier, and reporter within the group; offer a printed or AI-generated output option for students without devices.
Potential Risks	Lack of source quality, confusing air and surface temperature; directly applying results from different climates.
Mitigation / Contingency Plan	Provide printed worksheets, a prepared comparison table, and a sample AI summary.
Extension / Follow-up	Develop a 2-year monitoring design and failure/adjustment thresholds for the selected intervention.



Recommended Reading

- AIGUIDE. (2026). AIGUIDE WP2-A3 best practices report: AI tools for green decision-making in STEM higher education. Artificial Intelligence for Green Understanding, Insights & Decision Empowerment (2025-1-LT01-KA220-HED-000354784).
- Food and Agriculture Organization of the United Nations. (2013). Climate-smart agriculture sourcebook. <https://www.fao.org/3/i3325e/i3325e.pdf>
- Intergovernmental Panel on Climate Change. (2022). Climate change 2022: Mitigation of climate change. Contribution of Working Group III to the sixth assessment report of the Intergovernmental Panel on Climate Change. Cambridge University Press. <https://doi.org/10.1017/9781009157926>
- Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. (2024). Summary for policymakers of the thematic assessment report on the interlinkages among biodiversity, water, food, and health. <https://doi.org/10.5281/zenodo.13850289>
- International Energy Agency. (2024). Integrating solar and wind: Global experience and emerging challenges. <https://www.iea.org/reports/integrating-solar-and-wind>
- International Organization for Standardization. (2006a). ISO 14040:2006 Environmental management—Life cycle assessment—Principles and framework. <https://www.iso.org/standard/37456.html>
- International Organization for Standardization. (2006b). ISO 14044:2006 Environmental management—Life cycle assessment—Requirements and guidelines. <https://www.iso.org/standard/38498.html>
- International Transport Forum. (2023). ITF transport outlook 2023. OECD Publishing. <https://doi.org/10.1787/b6cc9ad5-en>
- United Nations Environment Programme & Global Alliance for Buildings and Construction. (2025). Global status report for buildings and construction 2024/2025: Not just another brick in the wall. https://globalabc.org/sites/default/files/2025-03/Global-Status-Report-2024_2025.pdf
- United Nations Environment Programme, International Resource Panel. (2024). Global resources outlook 2024: Bend the trend—pathways to a liveable planet as resource use spikes. <https://www.unep.org/resources/Global-Resource-Outlook-2024>

