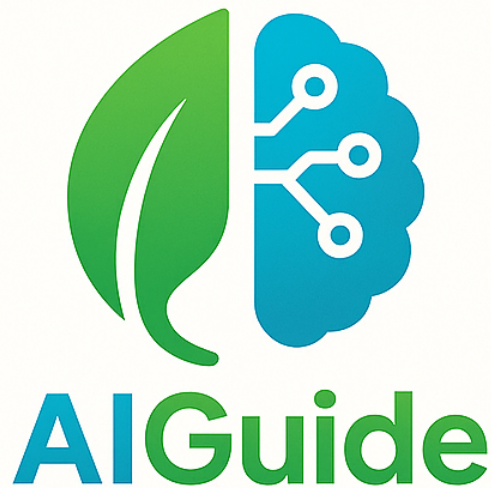




ONLINE COURSE CONTENT

MODULE 3: ENVIRONMENTAL AND SUSTAINABILITY AWARENESS

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Artificial Intelligence for Green Understanding, Insights & Decision Empowerment



SQUAREDEV



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A. General Information

Module No.	Module 3 – AI-Supported Green Decision-Making
Subtopic 3.1	Environmental and Sustainability Awareness
Artificial Intelligence Literacy Component	AI-supported environmental information; awareness of sustainability, climate, and environmental data
Decision-Making Skills	Problem definition; sustainability-focused evaluation; sustainability awareness
Teacher Learning Outcome	Define green decision problems using sustainability concepts and AI-supported evidence sources.
Student Learning Outcome	Relate AI-supported evidence to sustainability and green decisions.
Possible AI Tools	ChatGPT; Microsoft Copilot Chat; NASA Scientific Visualization Studio; En-ROADS; environmental data portals
AI Literacy Level	Basic
Estimated Time	60 minutes

B. Content

Key Points

- Green decisions are decisions that prioritize environmental impacts throughout the evaluation, implementation, and monitoring of options.
- Sustainability awareness requires considering environmental constraints, the life cycle, long-term environmental impacts, and the groups affected by decisions together.
- Green decisions consist of the following stages: problem definition, goal setting, evidence gathering, identifying options, making data-driven choices, and monitoring results.
- The current situation, trends, and targets are measured using environmental indicators; indicator selection is based on the decision-making context.
- Artificial intelligence provides support for tasks such as classifying data, comparing information across sources, and highlighting gaps in the evidence.
- The final problem framework, priorities, and rationale for decisions remain the responsibility of humans; AI outputs must be verified against original sources.

How to use

The boxes placed in Parts B and C are designed for educators — work through them as part of your preparation before teaching. The classroom activity for students is provided in Part D.

Introduction

Many professional decisions in STEM fields have environmental impacts. Material selection, equipment or infrastructure upgrades, production planning, the installation of energy-efficient systems, and the selection of software infrastructure can have varying impacts on resource use, emissions, waste, water, biodiversity, and human health. Therefore, green decision-making is not a specialized field limited to a specific discipline; it is a common way of thinking that STEM graduates will apply in various professional contexts.

This section addresses environmental awareness as the ability to understand environmental systems and the impacts of human activities; to interpret these impacts in terms of magnitude, duration, and life cycle; and to relate claims to reliable indicators and sources. Environmental awareness enables students to recognize an environmental issue and understand what information is needed to explain it. The green decision-making framework to be introduced at the introductory level encompasses the skills of recognizing the environmental and





sustainability dimensions of a decision, identifying its limitations and the necessary evidence, and defining the role of AI support. Subsequent subtopics will delve into evidence analysis, resource and energy efficiency, policy, ethics, and systems thinking.

Task: Observe—Notice | Video-based data visualization (3 min)

Instructions: Watch the NASA Climate Spiral animation. What indicator, base period, and long-term trend does the graph show? Expected focus: monthly global temperature anomalies, the 1951–1980 base period, and the long-term increase (NASA SVS, 2026). [Play video](#) · [source page](#)

Environment and Sustainability

The environment is a system in which the atmosphere, water, soil, climate, biodiversity, energy, and material flows interact with one another. In STEM applications, it is possible to understand the effects that occur when certain parameters in the system change. Material production consumes energy and water; production can generate emissions and waste; maintenance and the product’s lifespan affect total resource demand; and decisions made at the end of a product’s life—such as recycling or recovery—can initiate a new material cycle.

When assessing environmental impacts, it is necessary to consider the geographic scale, time frame, and the exposed ecosystem or community. This is because the same solution can produce different results in different climates or under different energy source or infrastructure conditions. Therefore, environmental awareness requires clearly articulating the mechanisms of impact and their limits.

The GreenComp framework addresses sustainability competence in the areas of embracing sustainability values, understanding complexity, designing sustainable futures, and taking action for sustainability (Bianchi et al., 2022). It must be carefully examined in this context. This framework demonstrates that green decisions must incorporate not only knowledge but also values, complex system relationships, and the capacity for action.

The life-cycle approach brings into focus the stages of raw material extraction, production, transport, use, maintenance and end-of-life within a single assessment framework. In this way, the relationship between improvements at one stage and the energy, water, emissions, toxicity or waste burden at another stage is examined. UNEP’s life cycle assessment guide emphasises the need to track direct and indirect impacts throughout the value chain and to clearly define system boundaries (UNEP, 2024a).

Task: Research and Learn | TECCHED Interactive Book – Causes of Climate Change (30 min)

Instructions: Read the “Causes of Change” section of the TECCHED interactive book and learn about the causes of climate change—including carbon footprint, deforestation, industrial choices, and climate change—from [the resource page](#)

Concept	Key Focus	Key Components	Evidence of Learning
Environmental awareness	Environmental systems, pressures, impacts, and evidence	System relationships; scale and boundaries; life cycle; indicators; sources and uncertainty	The student defines environmental impact, explains its scope, and selects an appropriate source of evidence.





Sustainability consciousness	The environmental, social, and economic connections of sustainable development	Knowledge and understanding; attitudes and values; behavior and action tendencies	The student explains the relationships between these dimensions, discusses values and responsibilities, and evaluates the consequences of action.
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What Makes a Decision “Green”?

In this subtopic, a “green” decision is considered a choice that incorporates the environmental and sustainability impacts of options into decision-making criteria, with its rationale and outcomes being traceable. The environmental significance of a decision also depends on the constraints chosen. For example, a new device with low energy consumption may have a completely different environmental profile when the materials used in its production, transportation, maintenance, lifespan, and end-of-life processes are taken into account. The life-cycle approach helps identify environmental impacts throughout the value chain and examine whether an improvement at one stage creates a new burden at another (United Nations Environment Programme [UNEP], 2024a).

Key control question: Which environmental impact does the decision aim to reduce; over what time frame, at what geographic scale, and during which life cycle stages is this impact assessed?

At Which Stages Does a Green Decision Take Shape?

A green decision does not consist of a single moment of choice. Environmental outcomes take shape within a process that begins when the problem is first articulated and continues as the results of implementation are monitored. The systematic flowchart below summarizes the decision-making process by breaking it down into the stages of problem-solving, goal-setting, information/data collection, understanding and justifying options, and identifying and evaluating impacts.

Stage	Key Question	Expected Action from a Green Decision Perspective	AI Support
1	What is the problem?	The subject, scope, constraints, and environmental aspects of the decision are defined.	Organizing problem statements and key concepts from the sources; the problem definition is created by a person
2	What do we want to achieve?	Sustainability goals, metrics, and relevant SDG links are identified.	Classifying goals and indicators; priorities are set by people
3	What do we know?	The baseline, trends, data sources, and uncertainties are examined.	Comparing and summarizing sources, and generating control questions regarding uncertainties
4	What options are possible?	Realistic options and their potential environmental, social, technical, and economic impacts are identified.	Creating an options and impacts checklist/table
5	Which preference can be justified?	Priorities are explained; the preference is linked to the evidence and criteria used.	Questioning the consistency of the rationale and drafting a decision matrix based on human-defined criteria
6	What was the outcome?	Monitoring is conducted using indicators; the decision is reviewed based on the results.	Organizing indicators and summarizing issues requiring change

A three-step approach is applied in this process: identifying the “green” dimension of the problem, establishing a connection with sustainability goals, and determining the necessary evidence. A detailed comparison of alternatives and a multifaceted analysis will be addressed in the following subsections.





The Role of Indicators and Evidence

The United Nations 2030 Agenda states that the 17 Sustainable Development Goals and 169 targets are integrated and indivisible; they balance the economic, social, and environmental dimensions of sustainable development (United Nations, 2015). Therefore, the SDGs provide a common framework for making the broader sustainability connections of a decision-making problem visible.

Environmental awareness becomes assessable when linked to the issue of green decision-making, indicators, and reliable evidence.

When interpreting an indicator, five elements are examined:

- Definition and unit: What exactly does the indicator measure?
- Baseline and trend: What is the current situation, and how is it changing over time?
- Target or threshold: Against which target, standard, or policy commitment are the results being compared?
- Scope and boundaries: What time period, region, sector, or user group does the data cover?
- Source and uncertainty: Who produced the data, is it up-to-date, and is there any uncertainty?

Decision-making based on indicators will be detailed in the next section.

Task: En-ROADS mini-simulation (5 min)

Instructions: Record the main temperature result and the “Total Final Consumption of Energy Sources” graph from the baseline scenario. Increase only the “Buildings and Industry – Energy Efficiency” lever setting by one notch; observe the same two outputs again. What has changed, what has not changed, and which assumptions or scale limitations of a global model prevent the direct application of its results to a local decision?

Open the simulator: [En-ROADS](#). This task does not generate decisions; it makes the relationship between indicators, assumptions, and time lags visible (Climate Interactive & MIT Sloan, 2026).

AI-Supported Environmental Awareness

AI-powered tools can help transform existing environmental information into a structure suitable for the decision-making problem. For more detailed information on how generative AI assistants can be used for tasks such as document summarization, data interpretation, evidence-based reasoning, and making sense of sustainability data, please review the AIGUIDE Best Practices Report.

However, generative AI may misplace a statement from a document, fill in missing information with a seemingly plausible sentence, or cite pages and sources that do not actually exist. In instructional design, the task expected of AI must be clearly defined; the documents used, prompts, verification steps, and human-made decisions must be kept transparent. For more detailed information on the human-centered, ethical, safe, equitable, and meaningful use of generative AI in education—as well as the protection of data privacy—please review the [Guidance for generative AI in education and research](#).

Appropriate scope of tasks: AI can organize contextual information and support the inquiry process. The scope of the problem, its level of importance, and the final decision on priority are determined by the teacher and students.

Tools That Can Be Used in the Classroom When Teaching This Topic

- ChatGPT: Structuring objectives, indicators, trends, and evidence gaps in uploaded reports; creating checklists for defining environmental problems.
- Microsoft Copilot Chat: Review reports in Word documents and indicator tables in Excel; edit a report or presentation draft using an evidence table.
- SKA dashboards: Link the decision-making problem to relevant goals, objectives, and indicators.
- Environmental data portals: Accessing reliable baseline data in areas such as air, climate, energy, water, waste, land use, and biodiversity.
- NASA Scientific Visualization Studio: Present the “Climate Spiral” video/visual and its text alternative.
- En-ROADS: Optionally examine the impact of variables on indicators and model outputs.





Students choose between ChatGPT and Microsoft Copilot Chat based on task suitability, accessibility, privacy, limitations, and the document format they will use. Their tool selection is documented with a brief rationale.

Critical and Responsible Use

- Every key claim, report, data portal, or reliable independent source used is verified.
- Document titles, page numbers, dates, and numerical values in AI outputs are cross-checked against the source.
- Missing data and uncertainties are clearly stated in the rationale for the decision; the AI's ability to generate estimated values is restricted.
- Personal, confidential, unpublished, or organizationally sensitive information is not uploaded to the systems.
- The environmental impacts of AI systems are assessed throughout their life cycle, encompassing data preparation, model development and training, use, and infrastructure production. Energy, water, and mineral use; emissions; and electronic waste are direct areas of impact in this assessment (UNEP, 2024b).

Guidance Flowchart for Professional Development

Stage	Task
Understanding Global Climate Change	Follow the NASA Climate Spiral and examine the causes of global climate change using information from the teched e-book.
Subject Knowledge	Sustainability GreenCOMP
Understanding the Decision-Making Process	The EN Roads mini-simulation is examined, and a connection is established between the lesson content and the real-life example in Section C
Reading Indicators	An interactive learning activity is examined (see Section D), and requirements for in-class application are identified
AI Ethics Awareness	A brief table of ethical decisions is created to inform students about AI ethics.
Creating Your Own Example	An activity card similar to the one in Section D is created based on a problem appropriate to the lesson context.

C. Real-Life Example

Example: Determining the Municipality's Sustainability Priorities

The local municipality is preparing its work program for the new term. In the work program, based on publicly available environmental indicators, the municipality wishes to justify which of the following issues—energy consumption, transportation-related emissions, waste management, water losses, etc.—should be addressed as a priority in the next implementation period. Students will act as advisors guiding the relevant decision-making process.

Students will review at least two current publicly available reports from the municipality and one independent, reliable source. Using ChatGPT or Microsoft Copilot Chat, they organize the current status, trends, goals, and data gaps described in the reports into a single evidence table. Every significant AI output is verified against the original document. Students identify a priority area based on the scale of the problem, the direction of the trend, its environmental significance, its relationship to municipal goals, and the adequacy of the evidence.

This sample decision output includes an explanation of the prioritized sustainability issue and the evidence base for the decision. Students may propose an initial action for implementation; a comprehensive comparison of policy tools can be developed in subsequent lessons using the information provided in Subtopic 3.4, while a detailed assessment of equity and stakeholder impacts can be developed using the information provided in Subtopic 3.5.

If no local government resources are available: The teacher provides two publicly available reports from any organization along with a short list of resources.





Preparing Your Own Real-Life Example

- Select a real-life decision-making context in your discipline that could produce environmental outcomes.
- Define the scope of the decision and its life cycle boundaries in a single sentence.
- Identify at least 3 reliable sources of evidence that students can access.
- Identify indicators that will show the current situation, trends, goals, and uncertainties.
- Explain in which regulatory or inquiry task the AI will be used.
- Describe the decision students will make and the characteristics of acceptable justifications.

D. Interactive Learning Activity

Student Learning Activity Card

For STEM college students

Project	Artificial Intelligence for Green Understanding, Insights & Decision Empowerment
Objective	A student activity that links artificial intelligence literacy with environmental and sustainability awareness
Target Audience	STEM higher education faculty members / facilitators
End Users	STEM higher education students
Version / Date	V1 / July 14, 2026
Card Usage: This activity transfers the awareness of green decision-making developed in Subtopic 3.1 to the student level. Students use publicly available resources, select one of the two provided tools, and make their own final priority decision.	

1. Activity Description

Module / Subtopic	Module 3 – AI-Supported Green Decision-Making Main alignment: 3.1 Environmental and sustainability awareness Secondary connections: 3.4 Climate Policy and Organizational Decisions; 3.5 Ethics, equity, and multi-stakeholder perspectives
Activity Code	M3-A3.1-S1
Event Title	Green Decisions for Local Government
Developing Partner	EDUJI
Recommended Duration	120 minutes in class + independent research
Delivery Format	In-class Synchronous online Asynchronous online Blended
Student Grouping	Individual Pairs Small groups (3–4 students) Whole class
STEM Context / Discipline	Interdisciplinary STEM; environment, energy, construction, transportation, urban planning, computer science, agriculture, and related engineering fields





2. Pedagogical Design

Learning Objectives	By the end of the activity, students will: 1. Examine environmental indicators and sustainability goals in municipal reports. 2. Prioritize actions for a local sustainability action plan by using state of the art, trends, environmental impacts. 3. Select an appropriate AI tool, validate its output, and take responsibility for the final prioritization decision.
Goal: AI Literacy	Understanding AI concepts Using AI tools critically Evaluating AI outputs Human–AI decision-making Ethical/responsible use
Focus on Green Decision-Making	Climate change Energy Materials/resources Biodiversity Waste/circularity Water Other: local sustainability
Prerequisite Knowledge	Knowledge of sustainability, environmental indicators, and basic source citation
Key Concepts	green decision; environmental awareness; sustainability indicator; problem definition; constraints; source verification; responsible use of artificial intelligence

3. Design of the Student Assignment

Student Scenario / Assignment	Your team is an advisory group providing input on your local municipality’s sustainability action plan. The municipality wants to determine which of the following areas—energy, transportation, waste, water, or climate adaptation—it should prioritize. Using publicly available municipal reports and supporting evidence, identify the priority issue and justify your decision.
Student Guidelines	Step 1 – Engage: Identify your municipality and 3–5 sustainability areas to examine. Note which area you initially think should be prioritized and record one of your assumptions. Step 2 – Explore: Find at least two current public reports from the municipality and one independent, reliable source. Choose a tool from either ChatGPT or Microsoft Copilot Chat; justify your choice in terms of task suitability, accessibility, privacy, and limitations. If local sources cannot be found, use the alternative municipal reports provided by the teacher. Step 3 – Explain: Prepare an evidence table that includes the current situation, trends, goals, environmental impacts, affected groups, and gaps in evidence. Use AI to organize and query the information. Verify every key finding within the original reports. Step 4 – Elaborate: Compare up to three sustainability areas in terms of the scale of the problem, the direction of the trend, environmental significance, and alignment with municipal goals. Have your team select a priority area, propose an initial action, and explain what additional evidence could support the decision. Step 5 – Evaluate: Submit your report or presentation, the evidence table, the bibliography, and the AI prompt log. Answer the reflection questions by comparing your initial perspective with your final decision.
Input Materials	Dataset Case study text Article Image/video Policy document Other: municipal strategic plan, climate action plan, activity and sustainability reports
Expected Student Output	Short report Decision matrix Presentation Poster/infographic Reflection Discussion post Other: evidence table and AI interaction log
Submission Format	The student group selects one of the following options: (a) a 1,500–2,000-word report or (b) an 8–10-slide presentation. A one-page evidence table, a bibliography, and an AI prompt log must be included with the output.





4. Use of Artificial Intelligence and Sustainable Decision-Making

Recommended AI Tools	• ChatGPT – To structure the goals, indicators, trends, and evidence gaps in uploaded municipal reports. • Microsoft Copilot Chat or Claude – Review reports in Word documents and dashboards in Excel; edit a report or presentation draft. Students select one of the tools; record the tool’s name and version; and justify their choice in terms of task suitability, accessibility, privacy, and limitations.
AI Prompt / Interaction Guide	Sample prompt: “Based solely on the attached [Municipality] reports, organize the current status, trends, goals, and gaps in evidence described in the areas of energy, transportation, waste, water, and climate resilience into a table. Specify the document name and page number for each item. Separate documented information from your interpretations; do not generate data.” Follow-up prompt: “Propose an unbiased analytical framework to compare the magnitude of the issue, the direction of the trend, the environmental significance, the relationship to municipal goals, and the adequacy of evidence for up to three areas. Do not make the final prioritization decision and clearly indicate any missing data.”
Critical Evaluation	Students evaluate the AI output based on the following criteria: accuracy bias source quality uncertainty environmental suitability ethical implications
Human Decision Component	Students determine the scope of the problem areas, which indicators are important, and which area the municipality should prioritize. They explain which AI recommendations they accepted, modified, or rejected.
Responsible AI / Ethics Note	Only publicly available documents are used. Personal, confidential, or unpublished municipal data is not shared. Numerical values, citations, and page numbers provided by the AI are verified against the original report. Underrepresented groups and environmental impacts are also examined.

5. Evaluation and Evidence

Evaluation Method	Checklist Short quiz	Graded rubric	Peer feedback	Teacher feedback	Self-assessment
Assessment Criteria	1. Problem definition and sustainability framework – 25% 2. Quality, timeliness, and traceability of evidence – 30% 3. Critical and transparent use of artificial intelligence – 25% 4. Rationale and communication of the prioritization decision – 20%				
Evidence to Be Collected	Student output record	Screenshot/recording of AI interaction	Reflection form	Attendance	
Success Criteria	A score of at least 70/100; all key claims linked to sources; clarification of ambiguities; and students justifying the final prioritization decision				
Feedback Questions	1. Which municipal evidence most influenced your prioritization decision? 2. Which AI output did you question, correct, or reject? 3. Why did your initial opinion remain the same or change compared to your final decision?				

6. Application Notes

Teacher Preparation	Examine the scenario in Section 3.1, p. 8, of the AIGUIDE WP2-A3 Best Practices Report in the context of municipal energy reports. Provide links to local municipal portals, an evidence table template, a resource quality checklist, and a brief guide to accessing the tools. Prepare a backup document package consisting of two publicly available municipal reports for students who cannot find local resources.
Time Schedule	Introduction and opening discussion: 15 min Resource and evidence review: 35 min AI-assisted structuring: 25 min Comparing priority areas and decision-making: 25 min Peer





	feedback: 10 min Reflection: 10 min
Accessibility / Inclusion	Allow students to use the language they are most proficient in for their reports, if accessible. Rotate group roles among evidence coordinator, AI interaction coordinator, sustainability coordinator, and rapporteur. Document options for report or presentation submission.
Potential Risks	Inability to access current municipal reports; AI generating source or page numbers; scope of the problem being too broad; varying access to tools among groups
Precautions/Contingency Plan	Provide backup municipal reports and printed document sections. Keep a sample AI output on hand for offline use. Require page-level verification and offer a document-based work option to groups without tool access.
Expansion / Continuation	Develop two policy options for the selected priority when transitioning to Subtopic 3.4. In Subtopic 3.5, detail the impacts of these options on different stakeholder groups and equity.

Joint Completion Checklist

1	A card has been prepared for the event.	Yes
2	The activity is designed for students.	Yes
3	The connection between AI literacy and green decision-making is clear.	Yes
4	The guidelines are concrete and sequential.	Yes
5	The use of artificial intelligence is transparent and ethically grounded.	Yes
6	Evidence of output and evaluation is provided.	Yes
7	Can be implemented by STEM faculty without additional explanation.	Yes
8	Accessibility, duration, and contingency plans have been addressed.	Yes



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