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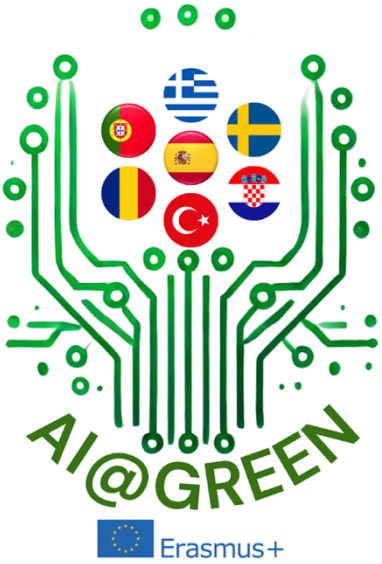

Recycling and Waste Management

Q1A2: Pedagogical Methodology Planning

2025

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Tackling the eco-sustainability as theory and practice…

"Development that meets the needs of the present without compromising the ability of future generations to meet their own needs"

(World Commission on Environment and Development, 1987)

Introduction

Welcome to the e-module on "Recycling and Waste Management." This course is designed to equip educators with the knowledge, resources, and strategies needed to address two of today's most urgent sustainability challenges: the growing volume of waste and the need for effective recycling systems.

Waste generation has become a critical environmental and social issue, impacting ecosystems, public health, and climate change. Understanding the sources, consequences, and management of waste is essential for developing responsible global citizens who can make informed decisions about consumption and disposal.

At the same time, recycling and sustainable waste management offer powerful solutions for reducing environmental harm, conserving natural resources, and moving toward a circular economy. By exploring these interconnections, this module highlights the importance of sustainable practices and encourages critical thinking and problem-solving among students.

Throughout this module, you will discover engaging teaching methodologies, interactive classroom activities, and real-world case studies that bring the topic of waste to life. Together, we can inspire the next generation to rethink waste, embrace recycling, and take meaningful action toward a cleaner, more sustainable world. Let's begin this journey toward environmental awareness and impactful education!

Learning Goals Vs Learning Objectives

Learning Goals

1. To empower teachers with knowledge and skills to address the global challenges of recycling and waste management in their classrooms.
2. To promote critical thinking and environmental awareness among educators and their students.
3. To inspire the integration of sustainable practices into educational settings, encouraging positive actions for the environment.

Learning Objectives

By the end of this e-module, teachers will be able to:

1. **Explain** the causes, effects, and global implications of waste generation and the role of recycling in reducing environmental impacts.

2. **Identify** practical strategies to introduce recycling and waste management topics in engaging and age-appropriate ways for their students.

3. **Analyze** real-world case studies that connect recycling, waste reduction, and circular economy practices.

4. **Develop** lesson plans and classroom activities that encourage students to think critically about waste, consumption, and sustainability.

5. **Facilitate** meaningful discussions and projects to inspire student-led initiatives for responsible consumption, waste reduction, and community-based recycling solutions.

Teaching Sustainability: Exploring Recycling and Waste Management in the Classroom

Pedagogical Guidelines:

This e-module is designed to support teachers in integrating the topics of **recycling and waste management** into their lessons, fostering environmental awareness and sustainable habits among students. The following guidelines will help you maximize the module's potential:

- **Active Learning**

Engage students with interactive activities, group projects, and problem-solving exercises to explore how waste is generated, the challenges of waste management, and the importance of recycling in creating a sustainable future.

- **Real-World Connections**

Use case studies and everyday examples—such as household waste, school cafeteria waste, or local recycling programs—to help students connect theory to practice and think critically about solutions in their own communities.

- **Interdisciplinary Approach**

Integrate these themes across subjects like science (waste decomposition, recycling processes), geography (landfill sites, global waste issues), economics (cost of waste, recycling industries), and citizenship education (personal responsibility and community action).

- **Student-Centered Learning**

Facilitate projects that empower students to investigate local waste challenges, design recycling campaigns, or create upcycled products. Encourage them to propose and present actionable solutions for reducing and managing waste effectively.

- **Reflection and Assessment**

Include opportunities for reflection and assessment, such as debates on waste policies, journaling about personal consumption habits, or group presentations on recycling innovations. These methods will deepen engagement and evaluate learning outcomes.

Required Technologies and Resources

Technologies

- Access to a computer, tablet, or mobile device with internet connection.
- Presentation software (e.g., PowerPoint, Google Slides, Canva) for creating and sharing lesson materials.
- Online platforms or tools like Padlet, Kahoot, Google Classroom, or Canva AI for collaborative and interactive activities.

Resources

- The e-module content (lesson plans and activity guides).
- Multimedia materials, including videos, articles, and infographics on recycling and waste management.
- Access to relevant online databases or websites for research and exploration (e.g., UN Environment Programme, local recycling programs).
- Classroom materials such as presentations, printed worksheets, waste sorting cards, or simple hands-on activity kits (e.g., items for a recycling sorting activity).

These tools and resources will help you deliver engaging and impactful lessons that empower students to act for a sustainable future.

Lesson Plans

Lesson Plan 1: The 5Rs in Action – Rethink, Refuse, Reduce, Re-use, Recycle (AI Integration)

Objective:

Students will understand the principles of the 5Rs, analyze their practical applications in daily life and communities, and use AI tools to design creative solutions that promote sustainable waste management.

Duration: 60 minutes

Materials:

- Projector
- Canva accounts
- Tablets/laptops with access to AI (ChatGPT, Canva AI)
- Short intro video
- Sticky notes (for quick reflections)

Activities:

1. Introduction - The Waste Problem (10 min)

- **Play a short intro video**:

  Example: "The Lifecycle of a Plastic Bottle" (TED-Ed) or "Where Does Your Trash end Up?" (The Story of Stuff Project).

  Ask students:

  - "What problem did the video show?"
  - "Why isn't recycling alone enough?"

- **Briefly introduce the 5Rs.**

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2. AI Brainstorming – "Ask an AI Expert" (10 min)

- Students open ChatGPT (or another AI tool).
- Prompts to explore:
    - *"Give me 3 creative ways to reuse an old T-shirt."*
    - *"What are some ways schools can reduce food waste?"*
    - *"Which is more effective—refusing or recycling plastic bags?"*
- Students share ideas from AI with the class.

---

3. **Group Activity – AI + Canva Design Challenge** (20 min)

- Divide students into 5 groups. Students form small groups (3–4 students in each group).
- Each group chooses one R (Rethink, Refuse, Reduce, Re-use, Recycle).
- Task:
    1. Use AI (ChatGPT) to generate a slogan, facts, and tips for their R.
    2. Use Canva AI (Text-to-Image or AI design suggestions) to create a poster or infographic about their R.
        - Example: A poster that says *"Refuse Single-Use Plastics"* with an AI-generated illustration of reusable bottles.
- Teacher circulates to guide, making sure AI outputs are realistic and school-friendly.

---

4. Gallery Walk & Class Discussion (15 min)

- Students place devices on desks and rotate around the room to view each other's posters (like a physical gallery walk).
- Discussion questions:
    - Which R was easiest to visualise?
    - Which ideas from AI were helpful, and which needed to be rethought?
    - How can AI help us spread awareness about sustainability more widely?

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5. **5. Reflection** (5 min)

- Each student writes their personal 5R action either:
    - On a sticky note → post on a classroom "Green Action Wall".

AI Integration Benefits:

- Critical Thinking: AI helps explore multiple solutions quickly.
- Global Perspective: AI can bring in worldwide examples of sustainability.
- Innovation: AI suggests out-of-the-box reuse/reduce strategies.
- Decision-Making: Students learn to judge whether AI's solutions are practical or not.

Lesson Plan 2: Circular Economy - Turning Waste into Resources (AI Integration)

Objective:
Explain how poor waste management contributes to climate change. Identify sustainable waste management strategies used around the world. Use an AI tool to investigate current problems and suggest solutions for better recycling practices.

Duration: 60 minutes

Materials:

- Tablets/laptops with access to AI (ChatGPT)
- Projector/screen (for presentation and map)
- PowerPoint or slides on *Waste Management & Climate Change*
- Whiteboard + markers

Activities:

1. Introduction:

Warm-up – Think–Pair–Share (10 min)

Write the following prompt on the board:

- *"Where does our rubbish go after you put it in the bin?*
- *Has waste got anything to do with the climate?"*

Give students a minute to think quietly on their own, then let them discuss their ideas in pairs for 2 minutes.

Invite each pair to share their thoughts with the whole group and collect their ideas on the board.

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2. Input Phase – Teacher-Led Presentation (20 min)

Talk about how much waste the class usually throws away in one day.

Example:

Type of waste	How much per day?
Plastic	1 small package
Food	Half a fruit
Paper	2 pieces of paper
Cans/bottles	1 can

Calculate the waste per week

Multiply your numbers by 7 (to get one week).

For example: 1 plastic package × 7 = 7 plastic packages per week.

Discuss the impact on the climate

What happens with all this waste?

- Plastic does not decompose→it; it stays in nature for hundreds of years.
- Food waste that goes in the trash→releases methane gas when it is burned.
- Paper waste that is not recycled→more trees have to be cut down

Use Google Earth to show students how inefficient waste management has impacted climate change. This helps students visualise and understand the negative effects more cognitively.

3. AI Integration Activity (25 min)

- Students work in groups of 2–3.
- Write a short paragraph about your waste and its effect on the climate.

Then ask ChatGPT:

- "Can you improve my text? My draft: *I throw away a lot of plastic…*"
  ChatGPT will provide a clearer version, and you can choose which changes to apply.

After using ChatGPT, discuss in small groups:

- Did the answers help you understand better?
- What did you learn about your own waste?

---

4. Exit Ticket (5 min)
Students complete the sentence on a post-it or in their notebook:

> **"The most important thing I learned about waste and climate change today was…"**

The teacher collects a few responses (either verbally or by reading them after class) to check understanding and inform future lessons.

AI Integration Benefits:

- Improves writing with instant feedback.
- Supports different learning levels.
- Encourages reflection and collaboration.
- Builds confidence in expressing ideas.
- Strengthens digital literacy and climate understanding.

Lesson Plan 3: Composting and Organic Waste Solutions (AI Integration)

Objective:

- Knowledge & Skills for Teachers/Students: Understand the basics of composting and how it helps reduce waste and carbon footprint.
- Critical Thinking & Awareness: Reflect on how waste management connects to global environmental challenges.
- Sustainable Practices: Encourage students to think of actions they can take at home or in school to improve composting.
- AI Literacy: Learn how AI tools can support creativity, problem-solving, and environmental action.

Duration: 60-90 min

Materials:

- Computers or tablets with internet access
- Access to an AI chatbot (e.g. ChatGPT)
- Access to an AI art generator (e.g. DALL·E, Craiyon, Bing Image Creator, etc.)
- Whiteboard/projector for group sharing

Activities:

1. Introduction: (10 min)

Hook question: “What happens to a banana peel after you throw it away?”

Brief teacher explanation: Landfills vs. Composting.

Write the key question on the board: How can composting help solve waste problems?

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2. Exploring Composting with AI Chatbot (15 min)

Students in pairs/groups ask AI questions such as:

- "What is composting and why is it important?"
- "What can and cannot go into compost?"
- "How does composting help the environment?"

Each group notes three interesting facts and one surprising thing they learned.

Quick share in class.

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3. Creative Composting with AI Art Generator (15 min)

Students use an AI art tool to create an image that represents composting:

Example prompts:

- "A superhero made of compost who saves the Earth."
- "A compost bin in the future that turns waste into clean energy."
- "What happens if we don't compost?"

Students present their favorite AI-generated image to the group.

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4. Critical Thinking Challenge (15 min)

Groups return to ChatGPT (or another chatbot) and ask:

- "What are 3 ways my school could start composting?"

- “What are 3 mistakes people often make when composting?”

Groups then evaluate:

- Which solutions seem realistic for our school/ home?
- Which would be hard to implement, and why?

Short group discussion: How could AI help us solve real-world problems like waste management?

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5. Wrap-Up & Reflection (5 min)

Teacher asks:

- “What is one new thing you learned about composting?”
- “What is one new way you learned to use AI today?”

Optional: Students write a quick exit ticket:

If you were to teach someone younger than you about composting, how would you use AI to do it?

AI Integration Benefits:

Students demonstrate understanding by:

- Explaining composting in their own words.
- Creating AI-generated visuals that reflect the concept.
- Identifying realistic solutions for composting in their own context.

Lesson Plan 4: E-Waste: The Hidden Cost of Our Devices (AI Integration)

Objectives:

- Explain what E-waste is and why it's a problem
- Use math skills to calculate the hidden costs of electronic devices
- Apply AI tools to analyze data and suggest solutions
- Collaborate in groups to design a strategy for reducing e-waste

Duration:

60 - 90 minutes

Materials:

- Computers or tablets with internet access
- Access to an AI chatbot (e.g., ChatGPT)
- Whiteboard/projector for teacher presentation
- Slideshow (Canva presentation)
- Handouts for Students

Activities:

1. Introduction Starter – "What's in My Phone?" (10 min)

- **Presentation:**
    - Open the attached Canva presentation and show students an image of a smartphone with its internal components (metals, glass, plastics).
    - Ask: *"What materials do you think are inside your phone?"*
    - Play a short 1-min clip on e-waste and its global impact.
- **Think-Pair-Share:** Students brainstorm what happens to devices when they are thrown away.

2. Input & Guided Practice – The Hidden Cost (20 min)

- Teacher explains that each device has *hidden costs*:
  - Environmental cost → pollution, mining, waste.
  - Financial cost → production, recycling, disposal.
  - Human cost → unsafe recycling practices, child labor in mining.

- Math Connection:
  - Provide sample data (e.g., average smartphone contains 0.03g of gold, 15g of copper, costs €5 to recycle, but C200 to make).

📘 Student Handout: The Hidden Cost of Electronic Devices

Part 1 – What's Inside Our Devices?

Here are some average amounts of materials found in common electronics:

Device	Gold (g)	Copper (g)	Aluminum (g)	Plastic (g)	Cost to Recycle	Cost to Produce
Smartphone	0.03 g	15 g	25 g	80 g	$5	$200
Laptop	0.5 g	1,500 g (1.5 kg)	500 g	1,000 g (1 kg)	$20	$800
Tablet	0.04 g	200 g	150 g	400 g	$10	$400

💡 Fun Fact: Recycling metals saves huge amounts of energy!

- Recycling **aluminum** saves 95% of the energy compared to making new.
- Recycling **copper** saves 85%.
- Recycling **gold** saves nearly 100%.

  - Students work in pairs to calculate:
    - How much gold is in 100 phones, or 100 laptops, or 100 tablets?
    - If recycling recovers only 30% of metals, how much is lost?

- What is the financial loss of wasted metals?

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3. Group Task – "AI Waste Busters" (25 min)

Divide class into 3 groups and assign each group a scenario (e.g., *a family upgrading 6 phones, a school upgrading 120 laptops, a company replacing 8 printers*).

AI Integration:

- Students use an AI chatbot (like ChatGPT or teacher-provided AI tool) to brainstorm:
  - Creative ways to reuse, recycle, or donate devices.
  - Predict how reducing upgrades by 1 year saves resources.

- Math Challenge:
  - Groups calculate potential savings in money or resources using given data sets.
  - Example: *If one laptop contains 0.5 kg of aluminum, and recycling saves 95% of energy, how much energy is saved recycling 50 laptops?*

- Output: Groups prepare a quick "E-Waste Pitch" (2–3 minutes) showing their math + AI solution.

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4. Math Challenges - additional task, only include if you have a 90 min lesson (30 min)

Students can work individually or in pairs on Question 1-3, and in groups

Question 1. Gold Rush

A smartphone has **0.03 g of gold.**

How much gold is in **100 smartphones**?

If gold costs about **$65 per gram**, what is the value of that gold?

Question 2. Recycling Reality

Recycling can only recover about **30% of metals** from smartphones.

1. If 100 smartphones contain **1,500 g of copper**, how much copper is recovered?

2. How much copper is lost?

Question 3. Laptop Energy Savings

One laptop has **0.5 kg of aluminum**. Recycling aluminum saves **95% of energy** compared to making something new.

1. If making new aluminum takes **200 units of energy per kg**, how much energy is saved by recycling the aluminum in 1 laptop?

2. How much energy is saved by recycling **50 laptops**?

Question 4. The True Cost

A family upgrades **4 smartphones every 2 years**.

1. What is the **production cost** of those 4 phones?
2. If each costs **$5 to recycle**, how much would recycling them cost?
3. Compare the recycling cost to the production cost. What do you notice?

Teacher Memo:

Q1. Gold Rush

Gold in **100 smartphones**: 0.03 g × 100 = 3 g

Value of 3 g of gold: 3 g × $65 = $195

Answer: 3 g of gold worth **$195**.

Q2. Recycling Reality

100 smartphones contain **15 g copper each** →15g×100 = 1500g or 1,5kg

Copper recovered (30%): 1500g×0.30 = 450g

Copper lost: 1500g − 450g = 1050g

Answer: 450 g recovered, **1050 g lost**.

Q3. Laptop Energy Savings

Energy saved for 1 laptop: 0.5 kg × 200 units = 100 units and 100 units × 0.95 = 95 units saved

For 50 laptops: 95 units × 50 = 4750 units

Answer: 95 units saved per laptop, **4750 units saved for 50 laptops**.

Q4. The True Cost

Production cost: 4 × $200 = $800

Recycling cost: 4 × $5 = $20

Comparison: $800 (production) vs. $20 (recycling) 800 / 20 = 40

Answer: Producing is **40 times more expensive** than recycling

5. Exit Ticket – "One Device, One Change" (5 min)

Each student writes on a sticky note (or submits digitally to the final page of the Canva presentation):

- One hidden cost of devices they learned.
- One way they personally can reduce e-waste.

AI Integration Benefits:

- The teacher presentation is made by teacher in minutes with embedded video and sticky notes application
- Students can use AI to quickly research how to identify and lower the cost of E-waste

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Lesson Plan 5: Waste Management and Climate Change (AI Integration)

Objective:

- Understand how waste contributes to climate change.
- Explore how AI can be used in real-world waste solutions (e.g., smart bins, image recognition).
- Practice critical thinking by comparing human vs. AI solutions.
- Develop teamwork, creativity, and presentation skills.

Duration: 60 minutes

Materials:

- Projector/Smartboard
- Laptops with AI access (ChatGPT)
- Pre-prepared slides with images of waste problems (overflowing bins, polluted river, landfill, composting site, etc.)
- Chart paper, markers
- Role-play "character cards" (e.g., Waste Monster, Climate Scientist, AI Robot, City Mayor, Student Activist). See on Canva Presentation above, slides 8 - 12

Activities:

1. Introduction: The Waste Monster is Coming! (10 min)

- Teacher shows an AI-generated cartoon of a giant "Waste Monster" made of trash.
- Story intro: "This monster grows when we waste things and releases gases that make the Earth hotter."
- Ask: *"What do you think feeds the Waste Monster?"* (Students call out answers: plastic, food waste, e-waste, etc.)
- Transition: AI and people can team up to defeat the monster.

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2. AI Image Detective – Spot the Problem (15 min)

- Show 5-6 real or AI-generated images of waste situations: landfill, street litter, composting, recycling center - presentation
- Divide students in groups of 3 or 4.
- Students use an AI tool (ChatGPT) to answer:
    - "What problem do you see here?"
    - "How could AI help solve it?" (e.g., AI cameras to spot recycling mistakes, smart bins that sort automatically).
- Groups share back one example: Problem + AI Solution.

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3. Role-Play: City Waste Council Meeting (20 min)

- Assign each group a role - Role Cards in Presentation
    - Waste Monster (wants to grow bigger!)
    - Climate Scientist (explains climate dangers)
    - AI Robot (suggests AI solutions)
    - City Mayor (decides policies)
    - Student Activists (suggest everyday changes)
- Task: The "city" must decide how to reduce waste and stop the Waste Monster.
- Students act out a short 2–3 min role-play where they debate what to do.
- Teacher helps ensure AI integration is part of the solution.

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4. Design Sprint: Future Smart Bin (10 min)

- Students sketch or describe their own AI-powered smart bin that helps fight climate change.
    - Examples: A bin that talks when you put waste in the wrong place, a bin that scans items, a compost bin that shows CO_2 saved.

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5. **Wrap-Up & Reflection** (5 min)

Exit ticket - ask students to discuss ideas how they can take what they learned today and pay it forward to educate others. Answers can be written up on the board by the teacher as a mindmap,

and a visual reminder to each learner how each one of them can play their part to manage waste, negate climate change and educate others.

AI Integration Benefits:

- Each group can build their own unique waste monster, which can make it more creative, interactive and engaging.
- Students are encouraged to use creativity and problem-solving skills when designing their waste bins with AI.
- The teacher can use AI to create the role cards for the debate.
- Students use AI to help build their arguments, using technology as a tool in teamwork.
- Students become more familiar with how AI works and how it benefits their learning.

Multimedia Materials

- **Videos:**
    - Wasted: 50 million tonnes of E-waste every year (Lesson 4)

- **Articles and Infographics:**

Online Databases and Websites

- Canva - https://www.canva.com/
- ChatGPT -
- Research Resources: Access to curated online databases, research articles, and educational websites to enhance students' understanding and research skills.
- Youtube

Classroom Materials

- Canva Presentations
    - o [The Hidden Costs of Electronic Devices]

- Handouts:

📘 Student Handout: The Hidden Cost of Electronic Devices

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- Hands-On Activity Kits: Encouragement for experiential learning and collaboration, where applicable.

- Printable Worksheets and Templates: Support for individual and group activities.

- Worksheets:

Lesson Plan 4: E-Waste: The Hidden Cost of Our Devices (AI Integration)

Worksheet: Math Challenges (30 min)

Students can work individually or in pairs on Question 1-3, and in groups

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