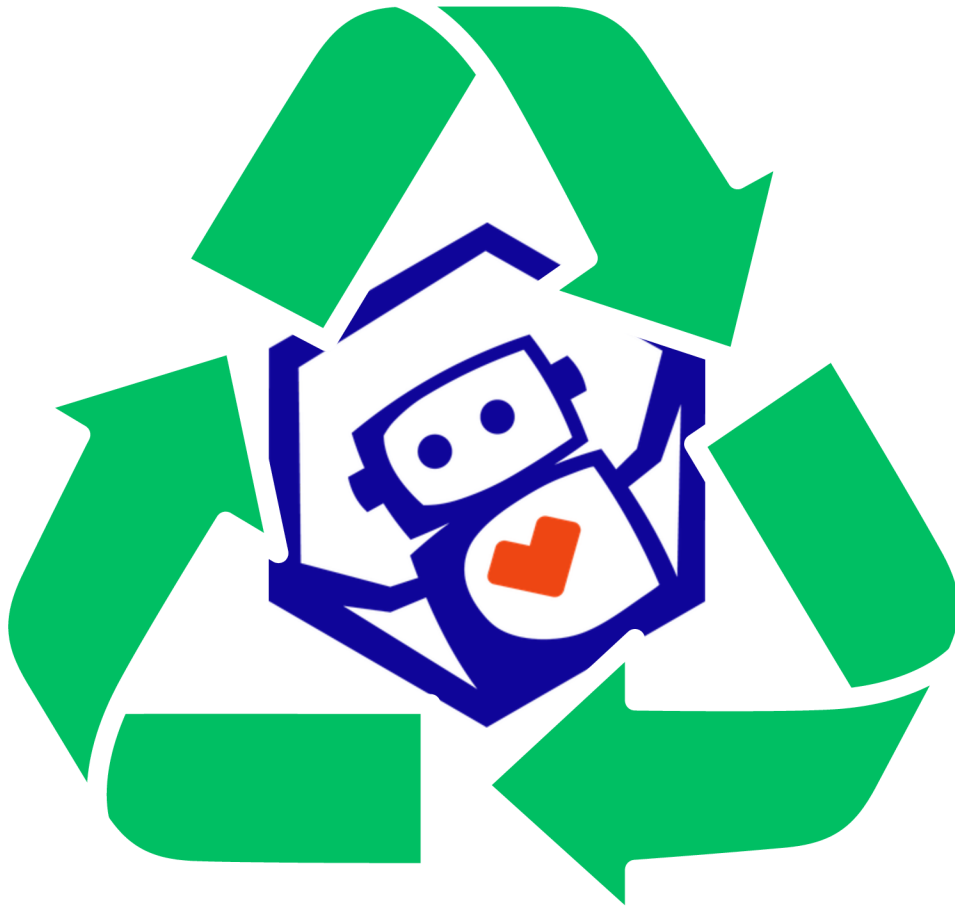


EU FOR ALL

Using Sustainable Entrepreneurship to Repurpose Europe's Heritage for All





**TEACHER GUIDE
FOR THE
SUSTAINABLE
BUSINESS -
PET FILAMENT
MAKER PATHWAY**



The resources of the EU FOR ALL project, including the materials kit, 3D models, and educational proposals, are undergoing continuous improvement. We are constantly working to incorporate new ideas, adjustments, and contributions from the participating teams. Therefore, both the documents and files may be reviewed and updated over time.

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PARTNERS:



1. Pedagogical context

- Related topics of the program
- Target group
- Developed competencies
- Methodological principles
- Differentiation opportunities

2. Sections of the curriculum

PHASE 1 – Warm-Up: Towards a sustainable world Understanding Plastic and Sustainability

- PHASE 2 – Research Phase: How to give plastic waste a new life? Exploring plastic recycling and circular innovation
- PHASE 3 – Creative Phase: Let's Find Out a New Product! Concept Object Design
- PHASE 4 – Design Phase: Prototyping with 3D Design and Recycled Filament
- PHASE 5 – AI Integration Phase AI-supported design improvement
- PHASE 6 – Presentation Phase – Prototype Presentation Pitch
- PHASE 7 – Student Self-Assessment Phase Reflection and Review

3. How to work on the lessons?

Suggested timeframe

- Breakdown into hours
- Teacher's aids

4. Lesson plans

5. Formative assessment

Team work

- Creativity
- Sustainability awareness
- Digital solutions
- Entrepreneurship



This teacher guide supports the EU FOR ALL – PET Filament Maker Pathway module.

This module is based on a student workbook that guides students step-by-step, using a design thinking approach, from sustainability issues – especially plastic waste – to making filament from recycled PET bottles, to creating and presenting an innovative 3D printed product.

The program is strongly linked to:

- sustainable business,
- the circular economy,
- the SDGs,
- design thinking approach
- digital and technological competencies (3D design, AI).

Target group

- Recommended: 10–18 years
- Designed for mixed-ability groups with an inclusive approach

Developed competencies

- Sustainability awareness
- Creativity
- Problem solving
- Entrepreneurial thinking
- Digital competence
- Collaboration and communication

Methodological principles

- Project-based learning
- Cooperative group work
- Visuality and action-orientedness
- Differentiation according to learning needs



PHASE 1 — Warm-Up: Towards a sustainable world Understanding Plastic and Sustainability

- Introduction to SDGs related to waste, circular economy and responsible production.
- Plastic waste in students' daily life.
- Data collection about plastic waste.
- Why PET bottles are a valuable recyclable resource.

PHASE 2 — Research Phase: How to give plastic waste a new life?

Exploring plastic recycling and circular innovation

- Learning about real-life initiatives that transform waste into new materials.
- Identifying useful objects that could be redesigned using recycled filament.
- Understanding the PET-to-filament process.
- Introduction to the filament-maker: purpose and functions.

PHASE 3 — Creative Phase: Let's Find Out a New Product!

Concept Object Design

- Brainstorming simple and meaningful objects for everyday use.
- Selecting one object to turn into a 3D printable version.
- Sketching the concept and defining its purpose.
- Connecting the object with sustainability impact and SDGs.

PHASE 4 — Design Phase: Prototyping Prototyping with 3D Design and Recycled Filament

- Designing the object in Tinkercad.
- Recapping the PET → filament transformation.
- Printing and testing the prototype.
- Testing the prototype.

PHASE 5 — AI Integration Phase AI-supported design improvement

- Using AI to make a user manual.
- Generating visual mockups of the object in real contexts.
- Using AI to refine object design (ergonomics, functionality, usability).

PHASE 6 — Presentation Phase - Prototype Presentation Pitch

- Explaining the PET → filament journey.
- Presenting the digital model and printed prototype.
- Showing sustainability relevance and SDG alignment.

PHASE 7 — Student Self-Assessment Phase Reflection and Review

- Reflecting on the design and prototyping process.
- Evaluating creativity, teamwork and technical progress.
- Peer feedback on prototypes and presentations.



We recommend 5*90 minutes to complete the module, depending on your capabilities, and the lesson plans are adapted to this timeframe. If you have less time, choose from the activities based on your own objectives, the characteristics of the learning group, and the technical background.

Óra	Phase	Focus
12	1 - Warm-up	SDGs, plastic waste
3	2 - Research	PET → filament, solutions
45	3 - Creative	Product ideas
67	4- Design	3D design, prototype printing
8	5 - AI Integration	Using AI in product development, further development, mock-up
910	6 - Presentation 7 - Self- assessment	Pitch, evaluation

The lesson plans below, the user guides available on the website, the downloadable printer files, and tutorial videos will help you to implement the lessons.

We recommend that students work in groups of 2-5 this will develop their cooperation skills, communication, and creativity.

At the end of each lesson, the groups should briefly present their results, decisions, and plans. The downloadable Teacher Canva helps with this: create as many slides from each section as there are groups in which you have divided the class. This way, at the end of each section, the results of the different groups can be viewed one after the other in Canva. This facilitates the presentation and is a good summary of the work done and the knowledge acquired at the class level.

Lesson 1-2 – Warm-up: Sustainability and SDGs

SEN differentiation: – Pre-selected SDG cards with pictograms – Acceptance of oral response instead of writing – Pair work with a supporting student

Duration	Activity	Methodology	Tools / Resources
5 minutes	Warm-up: What does sustainability mean?	Guided discussion	SDG infographic (workbook)
10 minutes	Getting to know and interpreting the 17 SDGs	Group work	Workbook, https://sdgs.un.org/goals
20 minutes	Linking the SDGs to the problem of plastic waste	Group work	Workbook, SDG icons, https://sdgs.un.org/goals
20 minutes	Creating a short video about plastic waste and the use of PET bottles	Video creation	Mobile phone / tablet
5 minutes	Creating a word cloud	Group work	Workbook, word cloud generator app
20 minutes	Data collection and infographic creation	Individual work	Internet, presentation tools (e.g. Canva) and AI generators (e.g. ChatGPT or NotebookLM)
10 minutes	Summary and reflection	Whole-class instruction, group presentations	Teacher's Canva

Lesson 3 – Research Phase: PET bottle → filament

SEN differentiation: - Unpacking the process from picture cards - Short, keyword explanations - Teacher-led questions (yes/no, multiple choice)

Duration	Activity	Methodology	Tools / Resources
5 minutes	Summary of the previous lesson	Q&A	Workbook
20 minutes	Research: plastic waste and recycling	Guided research	Internet, workbook
10 minutes	How a PET → filament conversion machine works	Watching a video, then pair work	Internet, workbook, https://youtu.be/aADs2l-m0cw?si=le4j7L-vLYOGx5Uj
10 minutes	Examples of 3D-printed objects made from recycled PET	Pair work, discussion	Internet, workbook,

Lesson 4-5 – Creative Phase: Product Ideas

SNI differentiation: – Choosing from existing product samples – Brainstorming with drawings instead of text – Developing only 1–2 ideas is acceptable

Időtartam	Tevékenység	Módszertan	Eszközök / források
10 minutes	Introduction to 3D design	Explanation	Projector
30 minutes	Creating a 3D digital model	Individual / pair digital work	Computer, Tinkercad
20 minutes	Examining filament properties	Observation	PET filament sample
20 minutes	Planning prototype creation and testing	Design work	Workbook
10 minutes	Reflection	Group discussion	Workbook

Lesson 6-7 – Design Phase: Prototype and 3D Design

SNI differentiation: - Modification of pre-made basic shapes - On-screen, step-by-step instructions - Analysis of prototype testing instead of design

Duration	Activity	Methodology	Tools / Resources
12 minutes	Introduction to 3D design	Video tutorial	Projector, Internet, https://youtu.be/zMIOUaLvFK4?si=lwm57gEhyOQjF4oX
30 minutes	Creating a 3D digital model	Individual / pair digital work	Computer, Tinkercad, tutorial video: https://youtu.be/zMIOUaLvFK4?si=lwm57gEhyOQjF4oX
12 minutes	Review of PET → filament conversion and 3D printer operation	Watch video, create process diagram in pairs	Internet, presentation creation application https://youtu.be/krzdt2lnT7I?si=aDkl2GVwklch3Bfc
20 minutes	Prototype creation	3D printing, observation	3D printer, workbook
10 minutes	Testing	Observation, self-reflection, calculations	Workbook
6 minutes	Reflection	Group discussion	Teacher's Canva

Lesson 8 – AI Integration Phase

SNI differentiation: – Use of predefined, simple prompt templates – Pair work with a supporting student – Emphasizing visual outcomes over text.

Duration	Activity	Methodology	Tools / Resources
5 minutes	The role of AI in product development	Explanation, brainstorming, discussion	Workbook (AI Integration section)
10 minutes	Creating a user manual with AI assistance	Pair work, interpreting and creating AI prompts	Workbook, Computer / tablet, AI tool
10 minutes	Creating a mockup or visual design with AI	Pair work, crafting and refining AI prompts	Workbook, Computer / tablet, AI tool
10 minutes	Further product development with AI	Pair work, crafting and refining AI prompts	Workbook, Computer / tablet, AI tool
5 minutes	Discussing AI-generated results	Group analysis	Teacher's Canva
5 minutes	Reflection: how did AI help?	Whole-class reflection	Teacher's Canva

Lesson 9-10 – Presentation Phase: Pitch and evaluation

SNI differentiation: – Use of short, pre-written sentences – Emphasizing visuals (drawings, mockups, objects) – Role-based speaking (e.g. only presenting the product)

Duration	Activity	Methodology	Tools / Resources
15 minutes	Concept and structure of a pitch	Explanation	Workbook
30 minutes	Preparing the pitch	Group work	Workbook, digital device
30 minutes	Team presentations	Presentation	Prototype, mockup
10 minutes	Peer evaluation	Evaluation form	Workbook
5 minutes	Closing reflection	Group discussion	Workbook

5 Formative assessment for teachers



Reflect on the work of your group and your product!

Team work

How engaged were the children with the challenge? 5 4 3 2 1

How good was the cooperation among the members of the group? 5 4 3 2 1

How well did the children manage to distribute the work among themselves? 5 4 3 2 1

Creativity

How original was the group's idea regarding recycled product? 5 4 3 2 1

How creatively did the group use the information they collected? 5 4 3 2 1

How creatively did the group come up with the new product? 5 4 3 2 1

Sustainability awareness

To what extent did the product idea exploit the potential of filament produced from PET waste? 5 4 3 2 1

To what extent have they managed to capture a real sustainability problem? 5 4 3 2 1

To what extent is the product idea linked to the SDGs? 5 4 3 2 1

5 Formative assessment for teachers



Evaluation of the group's work

Digital solutions

How varied was the group's use of digital tools?

5 4 3 2 1

How consciously did the group use digital tools?

5 4 3 2 1

To what extent have the members of the group developed their skills in using digital tools?

5 4 3 2 1

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The educational materials developed within the framework of the EU FOR ALL project, led by the consortium of OBO - We Teach Robotics, have been designed to promote digital inclusion and technological literacy.



These materials aim to provide accessible and engaging learning experiences that foster key competencies in digital skills, problem-solving, and critical thinking. Through interactive and hands-on approaches, the project seeks to empower learners of all backgrounds by equipping them with the necessary tools to navigate an increasingly digital world.

Developed in collaboration with experts in education, technology, and inclusion, these resources reflect the commitment of the EU FOR ALL consortium to innovation in education and the reduction of the digital divide.

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