



STEAM BO.SS

boosting soft skills

Sustainable Waste Challenge

Estonian Pilot Project



Sapere utile



UNIMORE
UNIVERSITÀ DEGLI STUDI DI
MODENA E REGGIO EMILIA



Saaremaa
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1. Title

“Sustainable Waste Challenge”

2. Topic

The Sustainable Waste Challenge is an educational project that connects learning with real-world environmental issues, focusing on waste management, community behavior, and sustainability. Inspired by challenges faced in local communities such as overflowing waste containers, improper disposal habits, and the environmental consequences of litter the project encourages students to become active problem-solvers and changemakers.

This is a project-based learning initiative that empowers students to tackle real-world environmental problems by rethinking how we deal with waste.

Students explore authentic driving questions like *“How do our daily habits affect waste generation?”* or *“What innovative solutions can make our city cleaner and more sustainable?”* Working in teams, they investigate the causes of waste problems, engage with community stakeholders, and prototype solutions that address both individual behavior and systemic waste management practices.

Through inquiry, collaboration, and hands-on experimentation, students learn to:

- Connect knowledge with practice by applying STEAM-subjects and social studies to real-life environmental challenges.
- Develop 21st-century skills such as critical thinking, problem-solving, proactivity, teamwork, effective communication and creativity.
- Create meaningful impact, for example by testing new waste-sorting systems, designing awareness campaigns or proposing innovative solutions.

The project has 3 main parts:

- **Game:** Creative Junk Mashup - which concentrates on understanding of waste generation and behavior.
- **Workshop:** Urban Environment Robotization project – trying to find innovative solutions (e.g. technologies, new systems) which could be used to tackle waste problems.
- **Panel discussion and debate:** “What options do communities or cities have to improve waste management?” – trying to raise public awareness and find how can each of us contribute to reducing waste and keeping our surroundings clean.

Partner organization:

- Kuressaare Regional Training Centre (Kuressaare Vocational School)

3. Age range

The group's students range in age between 15 and 16 years old.

4. Number of participants:

30 students in the 10th grade (K-12)

5. Description of the project:

ORGANISATION OF ACTIVITIES: August 26th – 27th

Nº of hours	Date	Activity
8	August 26 th	creativity, teamwork and innovation through upcycling and robotics
8	August 27 th	analysis and debate on waste management challenges and solutions

First day (August 26)

- Welcome and framing
- Waste Icebreaker: Each person says their name + one thing they sorted or reduced recently
- Presentation of the project and activities/challenges.
- Forming groups (5-6 students)

a) **Game: Creative Junk Mashup**

- **Purpose:** Using the SCAMPER Technique in Design Thinking.
 - To boost creativity, collaboration, and upcycling thinking through a fast-paced, hands-on game inspired by the SCAMPER method.
- **Preparation:** For each group is prepared collection of items - things that are no longer used but cannot be thrown away. Participants can also bring similar items from home. (Examples: a broken bracelet, a worn slipper, an old toy, a key with no lock...)

Game instructions:

- **The Pile:** Every group empties their bags into the middle of the room, creating one big, glorious junk pile.
- **Sort Round – “Color!”**
The game leader shouts: "**Color!**"
Everyone begins sorting the items based on color – pink in one pile, white in another, multicolored in a third, and so on.
- **Create Round – “Combine!”**

The leader calls: "**Combine!**"

Each player reaches into a color pile with both hands, pulls out **two random objects**, and puts them together to see:

- **Could this new hybrid object serve a new function?** (find connections with knowledge from the fields of STEAM (engineering, chemistry, technology)
Example: a pink toy bunny + a worn-out pink slipper = a comfy slipper again – the bunny covers the hole and makes it cute too!
- **More Rounds – Different Attributes:**
Repeat the sorting and combining based on other attributes:
 - "**Shape!**", "**Material!**", "**Function!**", etc.
- Encourage players to explore possibilities using the **SCAMPER** technique:
 - **S** – Substitute
 - **C** – Combine
 - **A** – Adapt
 - **M** – Modify (shape, color, function)
 - **P** – Put to other use
 - **E** – Eliminate or expand
 - **R** – Reverse or reimagine
- **(Optional) Poetry or Storytime:**
At the end, players can write a short **poem or story** about their hybrid creation.
Where did it come from? What's its new purpose? What's its name?

Outcome:

- Fun, fast, and full of laughter
- Sparks creativity and problem-solving
- Demonstrates the power of repurposing
- Applies the SCAMPER technique in a hands-on way
- Builds empathy through storytelling

Lunch break

b) Workshop: Urban Environment Robotization project

- **Supervised learning in Computer lab:** programming basics.
- **Challenge:** Waste Management and Urban Sustainability.
- Students programmed mBot robots to optimize logistics and clean up waste in a future city model, using Python and mBlock.
- Each group makes a presentation of their solution.

- Group-works presentations.

In the urban environment robotization project, group-works were evaluated not only on whether the robots completed the task, but also on how the students solved programming problems and adapted the robots to the urban environment:

- **teamwork** – the success of each group depends on their ability to share tasks, communicate and support each other. Each student can apply their strengths such as leadership, analysis or creative thinking.
- **creativity and problem solving** – during the project, students must find innovative solutions to real-world problems.

Feedback of 1st day

Second day (August 27)

c) Panel discussion and debate “What options do communities or cities have to improve waste management?”

Presentation of the head of the Environmental Department of Saaremaa Municipality about waste situation in local community.

The main problems that were highlighted:

- people are not satisfied with the frequency of emptying waste containers.
- people do not sort garbage according to its type.
- the cleanliness around waste containers is influenced by two important factors: the frequency of waste collection and the behavior of city residents.
- main problem arises from residents’ habit of leaving plastic bags with waste next to the containers or throwing unsuitable rubbish into them. (*“The problem is aggravated by users of packaging containers, who often throw packaging waste next to the containers or place trash that does not belong there into or beside them and after that birds scatter this litter around”).*

Questions & Answers session

Debate “What options do communities or cities have to improve waste management?” (*working in groups*)

Objectives:

- Students develop their teamwork, analysis and information-finding skills.
- Students must find information on the topic and analyze it, forming a new meaningful whole based on the information.

- Students understand societal bottlenecks, their causes, and possible solutions.

Tasks:

- Each student defines the most important social problem related to the waste management.
- Each student introduces the problem of their choice and writes keywords on the board.
- Based on similar keywords, students form groups of approximately 4–6 people. If necessary, several groups can deal with the same or similar problem.
- The groups will make a mind-map about their problem using some mind-map software (Miro, Lucid, Canva etc)
- The groups come up with reasons why:
 - the problem has arisen, i.e. what is the cause(s) of the problem.
 - it is a problem, i.e. what is the negative impact of the phenomenon.
- The groups come up with solutions to the problem, including evidence (expert opinions, statistical data, examples from other countries).
- Students present the results of their work. The teacher can oppose the student's solution, thus putting the group in a position where they are in a situation where they must defend their solution with explanations and proofs based on their preparation.

Summaries

- Post self-assessment questionnaire
- Satisfaction questionnaire

6. Didactic hours

(estimated duration of the training)

16 hours (spread over 2 days)

7. STEAM approach

Our project had 3 parts, each addressing different aspects of the STEAM approach.

Educational game “Creative Junk Mashup” is using SCAMPER method, students were expected to increase their capability to apply creative thinking skills in various situations and build their confidence to produce creative outcomes. This method is efficient in innovation and ideations sessions, to foster students’ creativity, critical thinking, and transfer of learning skills. During game students tried to find connections with knowledge from the fields of STEAM (engineering, chemistry, technology, art).

During robotization project students solve real-world problems, integrating knowledge from robotics and design to develop innovative solutions and enhancing soft skills.

Knowledge from engineering, science and technology can be supported by teamwork, public presentation and problem-solving skills.

The STEAM approach equips students with diverse skills, preparing them for future challenges in both technology and creativity. This micro-project integrates PBL with creative thinking tools and specific technological elements.

Discussion-debate develops following skills:

- **Teamwork:** groups are formed by similar views, group members must demonstrate autonomy and proactivity
- **Information-finding and critical thinking skills:** finding expert opinions, adequate info about problems, arguing with evidence
- **Public presentation skills:** teamwork presentations using effective visual aid software
- **Problem solving skills:** students will find causes of the problem, nature and consequences of the problem, negative impact of the phenomenon and solutions
- **Science, technology and math skills:** data analysis, using mind-map software
- **Respectful dialogue:** learning to disagree constructively and respectfully
- **Leadership:** taking initiative in guiding discussions or presenting ideas.

S – Science

- The scientific method in constructing challenges to produce creative outcomes, finding connections with knowledge from chemistry, technology etc, formulating critical thinking questions.

T – Technology

- integrating knowledge from robotics to develop innovative solutions; project-based-learning was integrated with creative thinking tools and specific technological elements

E – Engineering

- integrating knowledge from engineering and design to develop innovative solutions

A – Arts

- During educational game elements of art have been used
- Graphic design of project-works

M – Math

- programming mBot robots to optimize logistics and clean up waste in a future city model, using Python and mBlock.
- Programming basics skills

8. Soft skills developed through the project:

Problem-solving: participants looking solutions for waste management and urban sustainability problems

Creativity and critical thinking: participants tried to find connections with knowledge from the fields of STEAM and new functions for “junk”.

Teamwork and collaboration: participation and working in different groups during Junk mashup game and debating discussion.

Public presentation skills: presenting groupworks during debating-discussion and robotization project.

Communication and empathy in communication with audience: respectful discussion during debate

9. Assessment:

Self-assessment questionnaire

- Pre-questionnaire for students: <https://forms.gle/gGMDyPHEwp33Zrfe6>
- Post-questionnaire for students: <https://forms.gle/pB9uFCx38gDFVpuU9>

Satisfaction questionnaire

- Students: <https://forms.gle/BWxt3k53UPtWldFe7>
- Teachers: <https://forms.gle/8chkqkf2sQMWFpV5>

10. List of materials

- Laptops with internet access
- Computer lab with mBot robots
- Design, editing and presentation software: Miro, Lucid, Canva, PowerPoint, Sway
- Equipment for educational game
- Markers, paper, pen
- Collaborative workspace
- Assessment and feedback questionnaires

11. Venue

Classrooms, computer lab and aula.



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