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DataScEd4CiEn
DATA SCIENCE EDUCATION IN STEAM FOR CIVIC ENGAGEMENT AND SOCIAL JUSTICE FROM THE EARLY YEARS

# Scenario: Every bite counts:Tackling food waste together!



# Introduction

## Title

Every bite counts: Tackling food waste together!

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## Summary of the scenario

Students investigate the causes and consequences of food waste through an interdisciplinary STEAM approach that combines Design Thinking, data analysis, scientific inquiry, and sustainable product design. Throughout the project, students explore the environmental, social, and economic impact of food waste, analyse data related to food consumption and waste, and examine practical strategies for reducing waste at individual, community, and national levels.

Using the Design Thinking process, students empathise with those affected by food insecurity and environmental degradation, define key issues related to food waste, generate innovative solutions, and develop practical outcomes across different subject areas. Activities include analysing data using CODAP, investigating energy transfers through composting and biogas production, designing sustainable food packaging, and creating digital presentations to communicate their findings and proposed solutions.

The project concludes with students presenting their work, reflecting on their learning through self-evaluation, and considering how informed consumer choices and responsible food management can contribute to environmental sustainability, civic engagement, and social responsibility.

## Age of the students

The scenario has been designed to be implemented with grade 9 students (age 14).

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# ‘Data Science Content in STEAM for Civic Engagement and Social Justice from the Early Years’

Students engage in collecting, visualising, and interpreting data related to food consumption and food waste. The Science and Mathematics departments collaborate to analyse data, investigate the environmental impact of food waste, and explore sustainable solutions such as composting and biogas production, while Computer Science integrates digital communication and presentation through multimedia tools.

## Subjects and topics

The scenario is designed to be implemented in the next subjects: PSHCE (Personal, Social, Health, Citizenship and Economic Education), Mathematics, ICT, Science, English, Art, Design and Technology

## Real-life questions

**Real-life Questions**
The real-life questions that students will be asked to answer are classified:
**General question:** How can we reduce food waste in our community and inspire others to value every bite?

- **Empathize:** What do our eating habits reveal about how we value food?
- **Empathize:** Who is affected by the food we throw away, and how does it impact society and the planet?
- **Define:** How much food do we waste at home or at school, and why does it happen?
- **Define:** What are the environmental and social consequences of food waste in Cyprus and globally?
- **Ideate:** What solutions can we create to reduce food waste in our school or homes?
- **Ideate:** How can we encourage more sustainable food choices and reduce unnecessary food waste?
- **Prototype:** What sustainable food packaging solution or digital presentation can we design to promote food sustainability and reduce food waste?
- **Test:** How can we share what we have learned and created with others in a way that inspires positive change?

# Objectives and aims of the scenario

## 21st Century skills

The scenario aims to develop the following 21st-century competencies:

- **Critical Thinking:** Analysing data, evaluating evidence, and proposing sustainable solutions to reduce food waste.
- **Creativity:** Designing sustainable food packaging and creating digital presentations to communicate ideas effectively.
- **Collaboration:** Working collaboratively to investigate problems, develop solutions, and share responsibilities throughout the project.
- **Communication:** Presenting findings, participating in discussions, providing constructive peer feedback, and communicating ideas through a range of digital and non-digital media.
- **Digital Literacy:** Using digital tools such as CODAP, Canva, PowerPoint, NotebookLM, QR code generators, and multimedia resources to analyse data, create content, and communicate information effectively.

## Teaching approaches and learning strategies/theories

The methodology of this scenario is rooted in the Design Thinking process, which encourages students to engage empathetically with real-world challenges, define key problems, ideate creative solutions, develop tangible prototypes, and test their ideas through presentation and reflection. This human-centred approach supports meaningful learning and real-life impact.

The project also draws from project-based learning, where students investigate the issue of food waste across subjects and produce interdisciplinary outcomes such as sustainable food packaging and digital presentations. Inquiry-based learning is embedded through student-driven questions and data exploration in Science and Mathematics.
Collaborative learning strategies are used throughout, encouraging peer support and teamwork in both research and creative production. The scenario also promotes interdisciplinary learning, connecting PSHCE, Science, Mathematics, Design and Technology, and Computer Science, while encouraging students to apply knowledge holistically.

Finally, the scenario embraces social justice pedagogy by prompting students to reflect on fairness, food access, environmental sustainability, and responsible consumption, while empowering them to take meaningful civic action through their final products.

## National curriculum

This scenario aligns with key aims of the British National Curriculum, particularly in fostering students' understanding of real-world global challenges, cross-curricular connections, and skills for modern citizenship:

- **PSHCE (Citizenship and Personal Development):** Encourages students to explore ethical issues surrounding food consumption, develop empathy, and understand their role in promoting sustainability and social justice (linked to SMSC and Citizenship Education goals).
- **Science:** Develops students' understanding of energy transfers, ecological systems, and sustainable solutions such as composting and biogas production (linked to Working Scientifically and environmental sustainability objectives).
- **Mathematics:** Applies mathematical reasoning and statistical methods to real-world data, including the analysis and interpretation of food waste data and survey results.
- **Computer Science:** Develops digital literacy through the use of digital tools for research, content creation, presentations, and communication (e.g., CODAP, Canva, PowerPoint, NotebookLM), supporting the Computing curriculum's focus on digital competence and responsible use of technology.
- **Design and Technology:** Provides opportunities for students to design purposeful and functional products, applying the design process to create sustainable food packaging while using a variety of media to communicate ideas and promote sustainability (aligned with KS3/KS4 learning outcomes).

# Educational Scenario plan

## Διδακτικές Ενότητες

| **Name of the activity** | **Procedures** | **Time/Annex** |
|---|---|---|
| Lesson 1: Motivation to the Project – Every Bite Counts: Tackling food waste together! | | |
| **STEAM subject**<br>PSHCE | **Activities:**<br>• Students begin by completing a **Food Waste Habits Survey** to assess their prior knowledge and reflect on their | **Time:**<br>50 minutes<br>**Annex:**<br>PSHCE Food |

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| | own behaviours at home and at school.<br>• Class discussion based on the starter scenario **"The Price of the Bin"**, encouraging students to reflect on what happens to leftovers after family meals and whether food is wasted in their own homes.<br>• **Think–Pair–Share** discussion exploring food habits, cultural traditions, and food waste in Cyprus.<br>• Students explore the concepts of **food waste** and **social justice** through guided discussion, multimedia resources, and real-life examples.<br>• Students participate in a **Discussion Carousel**, examining the social, environmental, and economic consequences of food waste from multiple perspectives. | Waste Presentation<br><br>https://forms.office.com/Pages/DesignPageV2.aspx?subpage=design&FormId=NDDJMYASSk6bxgMrx7rMvBywFgAzAeRlmq2V857VHUFUREIQNkRSVzJQNERRWk41MzFOSThUS1BHWS4u |
| **Learning Outcomes** | By the end of the lesson, students will be able to:<br>• Reflect on their own food consumption and food waste habits.<br>• Explain the concept of food waste and its environmental, social, and economic consequences.<br>• Demonstrate an understanding of the relationship between food waste and social justice.<br>• Discuss food waste from personal, cultural, and global perspectives. | |
| Lesson 2: Investigating Food Waste and Planning for Action | | |
| **STEAM subject**<br><br>PSHCE | **Activities:**<br>• Students investigate food waste in Cyprus and discuss practical strategies for reducing food waste at | Time:<br>50 minutes<br><br>Annex: |

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| | home, at school, and within the wider community.<br>• Students generate research questions through the **Question Wall** activity, which guide the subsequent stages of the project.<br>• Students are introduced to the **Foodprint Calculator** and learn how to monitor and calculate the environmental and economic impact of household food waste.<br>• Students are introduced to the **Leftovers MasterChef Challenge**, during which they identify a commonly wasted food item at home, research a recipe to reuse it, and prepare to create a one-minute cooking video documenting the process. | • PSHCE Food Waste Presentation<br>• Foodprint Calculator<br>• Leftovers MasterChef Challenge instructions |
| **Learning Outcomes** | By the end of the lesson, students will be able to:<br>• Identify practical strategies for reducing food waste.<br>• Generate research questions related to food waste.<br>• Collect and analyse household food waste data using the Foodprint Calculator.<br>• Plan creative ways of repurposing leftover food through the preparation of a sustainable recipe. | |

## Lesson 3: Sharing and Reflecting on Sustainable Food Choices

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| **STEAM subject**<br><br>PSHCE | **Activities:**<br>• Students present and discuss the results of the **Foodprint Calculator** activity.<br>• Students share the recipes they selected to repurpose leftover food.<br>• Students watch one another's cooking videos and discuss different | **Time:**<br>50 minutes<br><br>**Annex:**<br>• Student cooking videos<br>• Foodprint Calculato |

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| | approaches to reducing food waste.<br>• Whole-class discussion on how individual actions can contribute to reducing food waste and promoting sustainable consumption.<br>• Reflection on how the knowledge and skills developed will support the remaining STEAM activities. | r results |
| **STEAM Subject:**<br>PSHCE | By the end of the lesson, students will be able to:<br>• Interpret and discuss the results of the Foodprint Calculator.<br>• Evaluate practical approaches to reducing household food waste.<br>• Communicate ideas and provide constructive peer feedback.<br>• Reflect on how individual choices contribute to environmental sustainability and social responsibility. | |
| Lesson 3: Introduction to CODAP – Basic Data Moves | | |
| **STEAM subject**<br>**Mathematics** | **Activity 1: Exploring the CODAP Environment (20 minutes)**<br>• Introduce CODAP and its interface (tables, graphs, and tools).<br>• Show how to navigate cases and attributes.<br>• Relate attributes to prior PSHCE discussions<br>• Ask students to describe what they see in the dataset.<br>**Activity 2: First Data Move – Filtering (10 minutes)**<br>• Demonstrate how to filter data by isolating a single attribute.<br>• Guide students in observing the distribution of the chosen attribute<br>• Facilitate a discussion on key characteristics (e.g., shape, center, variability, outliers).<br>• Encourage students to share initial observations and patterns they | Time:<br>50 minutes |

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| | notice.<br><br>**Activity 3: Second Data Move – Grouping (20 minutes)**<br><br>• Show how to group data by another attribute to compare subgroups .<br>• Ask students to analyze similarities and differences between the subgroups.<br>• Discuss real-world implications of the patterns they see.<br>• Encourage students to pose questions based on their findings. | |
| **Learning outcomes** | By the end of the lesson, students will be able to<br><br>• navigate the CODAP environment<br>• understand how to read and interpret datasets<br>• connect attributes to real-world discussions from PSHCE<br>• develop skills in filtering data to explore distributions and grouping data to compare subgroups<br>• Through hands-on investigation and discussion, students will enhance their ability to identify patterns, make data-driven observations. | |
| **Lesson 4 and 5 – Calculation and interpretation of statistical measures** | | |
| **STEAM subject**<br>Mathematics | **Third Data Move – Summarizing**<br>• Teach students how to calculate measures of location (mean, median, mode) and spread (range, IQR, standard deviation).<br>• Guide them in interpreting these measures within their dataset.<br>• Compare summary statistics across different subgroups.<br>• Wrap up with reflections: What did they learn? How does CODAP help in data exploration? | Time:<br>2 lessons 50 minutes each |
| **Learning outcomes** | By the end of this lesson, students will be able<br>• to calculate key measures of location (mean, median, mode) and spread (range, interquartile range) to | |

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| | summarize a dataset<br>• develop the ability to interpret these statistics in context, recognizing patterns and differences within their data<br>• compare summary statistics across different subgroups to draw meaningful insights<br>• through reflection, they will articulate their learning and evaluate how CODAP supports data exploration and analysis. |

**Lesson 6: Energy Transfers, Composting and Food Waste**

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| **STEAM subject:**<br>**Science** | **Activities:**<br>• Students apply their knowledge of energy transfers and energy efficiency to investigate whether producing compost from food waste can contribute to reducing environmental impact, improving soil fertility, and generating biogas for the production of electrical energy.<br>• **Part A:** Students construct an energy transfer diagram to analyse the transfer and transformation of energy during the composting process and evaluate the efficiency of the process.<br>• **Part B:** Students watch two videos and discuss how composting and biogas production can be implemented at both an individual and a national level. The first video demonstrates the construction of a small DIY compost bin, while the second illustrates how food waste can be used to produce biogas and generate electricity.<br>• **Part C:** Students work collaboratively to propose ways in which communities, and specifically The English School community, could make better use of food waste for the benefit of the environment and society. Each group records and justifies its proposals. | **Time:** 1 teaching period<br>**Annex**<br>• Energy transfer diagram.<br>• DIY compost bin video.<br>• Biogas production video.<br>• Student worksheet. |

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| **Learning outcomes** | By the end of the lesson, students will be able to:<br>• Explain the energy transfers involved in the composting process.<br>• Evaluate the efficiency of composting and biogas production.<br>• Describe how food waste can be transformed into useful products such as compost and biogas.<br>• Evaluate the environmental benefits of composting and biogas production.<br>• Propose evidence-based solutions for reducing food waste and improving the sustainable management of organic waste within the school and the wider community. | |
| **Lesson 7: Sustainable Food Packaging – Research and Design Planning** | | |
| **STEAM subject**<br>Design and Technology | **Activities:**<br>• Students are introduced to the **Sustainable Food Packaging Project** and investigate the role of sustainable packaging in reducing food waste and protecting the environment.<br>• Students explore different types of food packaging, comparing biodegradable, recyclable and non-biodegradable materials, and evaluate their environmental impact.<br>• Through **Think–Pair–Share**, students discuss which packaging materials are most suitable for different fruits and vegetables and | **Time:** 50 minutes<br>**Annex**<br>• Sustainable Food Packaging Presentation<br>• Packaging research activities<br>• Packaging symbols worksheet |

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| | justify their choices.<br>• Students investigate the purpose and functions of food packaging, including protection, preservation, transportation, information, branding and sustainability.<br>• Students learn about **nets (developments)**, identifying faces, tabs, fold lines and assembly techniques used in packaging design.<br>• Students examine how packaging is manufactured efficiently through tessellation and waste reduction techniques.<br>• Students investigate packaging symbols, certification marks, recycling labels and sustainability logos used on commercial food packaging.<br>• Students begin planning their own sustainable packaging solution by selecting suitable materials, packaging shape and branding ideas. | |
| **Learning outcomes** | By the end of the lesson, students will be able to:<br>• Explain the purpose and functions of food packaging.<br>• Distinguish between different packaging materials based on their sustainability.<br>• Explain how nets (developments) are used to create three-dimensional packaging.<br>• Recognise common packaging symbols and sustainability certifications.<br>• Plan a sustainable food packaging solution using appropriate materials and design principles. | |
| **Lesson 10: Designing and Producing Sustainable Food Packaging** | | |
| **STEAM subject**<br>Design and | **Activities:** | **Time:** 50 minutes<br>**Annex** |

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| Technology | • Students design and construct a sustainable food package using an accurately developed net.<br>• Students create appropriate graphics and branding for their packaging.<br>• Students include a short recipe demonstrating how leftover fruit or vegetables can be reused to reduce food waste.<br>• Students add nutritional information together with sustainability information, such as recycling guidance, storage advice or waste reduction tips.<br>• Students generate and test a **QR code** linking to the full recipe, cooking video or additional sustainability information.<br>• Students assemble and evaluate their final packaging design, considering functionality, appearance and environmental impact. | • Sustainable Food Packaging Presentation<br>• Canva<br>• QR Code Generator |
| **Learning outcomes** | **Learning Outcomes**<br><br>By the end of the lesson, students will be able to:<br><br>• Apply the design process to create a functional and sustainable food package.<br><br>• Construct an accurate packaging net and assemble a three-dimensional prototype.<br><br>• Communicate sustainability messages through graphics, branding and product information.<br><br>• Integrate digital technologies by creating and incorporating a functional QR code.<br><br>• Evaluate their design in terms of functionality, sustainability and visual communication. | |

## Lesson 11: Self-evaluation and Reflection

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| **STEAM subject**<br>PSHCE | **Activities:**<br><br>● Students complete a self-evaluation form reflecting on their learning throughout the interdisciplinary project.<br>● Students reflect on:<br>○ what surprised them most about food waste,<br>○ the skills they developed (e.g., Design Thinking, data analysis, digital communication, and collaboration),<br>○ the actions they can take in their everyday lives to reduce food waste,<br>○ how they contributed to their group's work.<br>● A whole-class discussion takes place on the impact of the project, students' experiences of presenting their work, and the most important knowledge and skills they gained.<br>● Students are invited to provide peer and teacher feedback on collaboration, creativity, and the overall learning experience. | **Time:** 50 minutes<br>**Annex**<br>• Self-evaluation form |
| **Learning outcomes** | By the end of the lesson, students will be able to:<br><br>● evaluate their own learning and contribution throughout the project.<br>● reflect on the knowledge, skills, and attitudes they developed during the project.<br>● identify ways in which they can apply more sustainable food consumption practices in their everyday lives.<br>● provide constructive feedback on collaboration and the learning process. | |

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## Timing

**STEAM PSHCE: 3 teaching periods**
**STEAM Mathematics: 2 teaching periods**
**STEAM Science: 1 teaching period**
**STEAM Design and Technology: 2 teaching periods**
**STEAM Computer Science: 2 teaching periods**
**STEAM PSHCE (Self-evaluation and Reflection): 1 teaching period**

## Teaching resources (materials & technological tools)

The materials have been linked as annexes in the sessions that are needed

### Online tools

- CODAP: https://codap.concord.org/app/static/dg/es/cert/index.html
- YouTube videos
- www.canva.com
- NotebookLM

# Evaluation

## Initial assessment

The initial assessment takes place during **Lesson 1: Motivation to the Project – Every Bite Counts: Tackling Food Waste Together!** Through brainstorming activities, class discussion, and the completion of the **Food Waste Habits Survey**, students' prior knowledge, attitudes, and everyday behaviours related to food consumption and food waste are explored. The information gathered provides a baseline for assessing students' understanding and awareness at the beginning of the project.

## Formative assessments

Formative assessment is conducted continuously throughout the project through classroom discussions, practical activities, student reflections, and the learning products created in each subject area.
Evidence of learning includes:

- Responses to the **Food Waste Habits Survey**.
- Participation in discussions and reflection activities during PSHCE lessons.

- Results from the **Foodprint Calculator** activity.
- Data analysis and statistical investigations completed in Mathematics using CODAP.
- Scientific investigations, energy transfer diagrams, and group proposals developed during the Science lesson.
- Sustainable food packaging prototypes developed in Design and Technology.
- Digital presentations (A3 poster, PowerPoint presentation, video, or podcast) created in Computer Science.
- Self-evaluation forms completed at the end of the project.

Assessment is supported through teacher observation, student participation, peer discussion, self-reflection activities, and the quality of the products created throughout the project. The Design Thinking rubrics are also used to evaluate students' progress throughout the different phases of the project.

## Final evaluation

The final evaluation is conducted through a student self-evaluation form, enabling learners to reflect on their learning, participation, and contributions throughout the project. Students evaluate their understanding of the issue of food waste, their engagement with the different stages of the Design Thinking process, their subject-specific learning, and their role in collaborative activities. The self-evaluation also provides opportunities for students to reflect on the knowledge, skills, and attitudes they developed throughout the project.

## Student feedback

Student feedback is collected through the self-evaluation process. Learners reflect on what they have learned about the environmental, social, and economic impacts of food waste, how they approached the project, and the skills they developed, including critical thinking, creativity, data analysis, collaboration, and digital communication. Students also consider how the project has influenced their awareness of sustainable food consumption and identify ways in which they can apply their learning to reduce food waste in their everyday lives.

## Teacher feedback

### Lesson plan

Teachers evaluate the implementation of the scenario, reflecting on its strengths, challenges, and overall effectiveness. Particular attention is given to student engagement, the integration of different subject areas, the effectiveness of the Design Thinking approach, and the suitability of the activities and resources used. Teachers consider how the interdisciplinary nature of the project enabled students to investigate the issue of food waste from multiple perspectives while developing both subject-specific knowledge and transferable skills.

## Students' dispositions

Teachers describe how students developed dispositions such as curiosity, empathy, creativity, critical thinking, environmental awareness, and social responsibility. They also reflect on how students formulated research questions, analysed data, evaluated evidence, collaborated effectively, communicated their ideas, and proposed sustainable solutions to reduce food waste.

## Revision of the scenario

Feedback gathered from students and teachers is used to identify opportunities for improving future implementations of the scenario. This may include revisions to the lesson sequence, timing, learning activities, resources, assessment methods, or the level of interdisciplinary collaboration, with the aim of further enhancing student engagement and the overall learning experience.