

R4.1. DataScEd4CiEn STEAM Scenario Template

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Introduction

Title

Numbers speak louder than words: What can we do to combat food waste in everyday school life

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Summary of the scenario

This lesson addresses the socially relevant issue of food waste and begins by asking in which areas particularly large amounts of food waste are generated. Based on a dataset on waste and food waste, students analyze the generation of food waste across various sectors and recognize that private households account for a significant portion of the total volume. In doing so, they acquire fundamental skills in working with data by reading, comparing, and interpreting it.

Building on these insights, students explore ways to reduce food waste in their own communities. The focus is on developing a food-sharing shelf for the school. Students reflect on their own consumption habits, learn about the concept of food sharing, and develop initial ideas for the implementation, design, and use of such a shelf. The lesson thus combines data-driven analysis with creative and socially responsible action and aims to make a concrete contribution to reducing food waste in a school setting.

Age of the students

The lesson unit is designed for 4th-grade elementary school students. Students have basic prior knowledge of mathematics, such as reading simple tables and diagrams and comparing quantities and sizes. They have initial experience with averages and can describe and interpret numbers in a practical context. In addition, students possess basic digital skills, such as using tablets or computers and simple, child-friendly applications.

In terms of content, the lesson builds on the children's everyday knowledge. Their experiences with food, grocery shopping, eating at home, and throwing food away are familiar to the students and provide a real-world foundation for exploring the topic of food waste. No specific prior knowledge of statistical data analysis, using Codap, or concepts such as food sharing is required; these skills are developed step by step throughout the lesson.

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

Subjects and topics

This lesson unit focuses on the social issue of food waste and integrates content from social studies, mathematics, and art within a transdisciplinary STEAM approach. The starting point is an exploration of sustainability and the responsible use of resources. In social studies, students examine how food waste is a global phenomenon that manifests differently in various countries. This establishes a connection to social justice, as food waste also highlights social inequalities within Germany—such as the contrast between abundance in private households and the simultaneous need for assistance among other people. Social studies thus fulfills its integrative role by connecting scientific, social, and real-world issues.

In the mathematics component, the focus is on working with real-world data on food waste. Students work with datasets in Codap, read and compare values, identify differences between countries and sectors, and interpret these findings in a practical context. Mathematics is thus used as a tool for describing and understanding a real-world problem. This approach is complemented by the design component, in which students develop concrete solutions. By planning, building, and designing a food-sharing shelf for the school, they creatively apply their insights. The STEAM approach thus contributes to solving the problem by linking data-based insights, social responsibility, and creative action, and by enabling students to engage actively and as members of civil society with the issue of food waste.

Real-life questions

What does data tell us about where a particularly large amount of food is thrown away, and what does that mean for our everyday school life?

Objectives for the scenario

Overall objective of the lesson unit:

Students recognize food waste as a societal problem, use data to understand that private households account for the largest share of it, and develop ideas for reducing food waste through a food-sharing shelf at their school.

Lesson 1 & 2:

Students ...

- identify which values and categories are represented in a dataset on food waste.

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- use Codap to compare the proportions of food waste across different sectors.

- determine that private households account for the largest share of food waste and justify this based on the data.
- read simple charts and tables, compare values, and describe notable differences.
- interpret average values in context.
- Reflect on possible reasons for differing values, e.g., between countries or sectors.

Lesson 3 & 4:

The students ...

- explain in their own words what food sharing means.
- describe where food waste is generated in their own environment and what happens to it.
- recognize food sharing as a way to reduce food waste and use available resources responsibly.
- are exploring the question of what role they themselves can play in reducing food waste.

Lesson 5:

The students ...

- develop ideas for using a food-sharing shelf at school.
- consider suitable locations, rules, and design options.
- design simple signs or decorative elements for the shelf.
- work cooperatively on a shared solution and contribute their own ideas.

Skills and competencies

Mathematics

1. Data, Frequencies, and Probabilities

Competencies:

Students...

- present data and frequencies in graphs and tables, including using digital math tools,
- extract data from calendars, charts, and tables and interpret it to answer questions involving mathematics and consumer-related topics,
- organize data (taking consumer-related topics into account) using tables, including digital math tools.

Learning through activity:

- Description of a given dataset on food waste in Codap
- Read and compare waste volumes across different sectors (private households vs. other sectors)
- Highlighting, comparing, and describing differences in charts
- Interpreting their results
- Using Codap as a digital tool
- Extracting information from a pie chart

2. Sizes and Measurements

Expected competencies:

Students...

- compare and order quantities (including data sets, lengths, weights (mass)),
- perform calculations with quantities (including decimals).

Support through activities:

- Calculating the arithmetic mean of the kg values in the sectors
- Organize and compare the arithmetic means of the different sectors

3. Process-related competencies: Modeling

Expected competencies:

Students...

- formulate their own questions within the context of real or simulated situations (e.g., in the form of word problems, equations, tables, or drawings),
- process relevant information obtained through counting, measuring, estimating, and researching using (digital) media,
- use appropriate representations (including terms, tables, sketches, and diagrams), including the use of digital math tools,
- relate the result back to the real or simulated practical situation and interpret it as a response to the task,

Promotion through activity:

- Translating the real-world question “Where does most food waste occur?” into diagrams in Codap
- Interpreting the results in a class discussion (“What do these numbers mean for our daily lives?”)

4. Process-related competencies: Communication

Expected competencies:

Students...

- explain their own approaches and ideas clearly,
- document their work results, approaches, and learning experiences,
- present solutions, ideas and results using appropriate forms of presentation and (digital) media,
- work on tasks together while adhering to agreed-upon arrangements or rules,

Promotion through activity:

- Joint evaluation of the data in a plenary session
- Justifying the statement that private households account for the largest share of food waste
- Discussion of possible causes based on the data

5. Process-related competencies: Presentation

Expected competencies:

Students...

- use mathematical symbols, tables, and diagrams they have developed appropriately,

- use (their own) analog and digital representations to work on problems,

Support through activity:

- Presentation of results in Codap
- Working with Codap

Social Studies

6. Nature and the Environment

Expected competencies:

Students...

- explain human impacts on the habitats of animals and plants,
- assess the importance of nature and environmental protection for preserving the living conditions of animals, plants, and humans, and identify possible courses of action.

Promotion through activity:

- Addressing food waste as part of sustainable practices
- Reflection on personal experiences with food and waste
- Identifying concrete courses of action in a school setting

7. Space and Mobility

Competency Expectations:

Students...

- compare the living situations of people in other environments with their own living situation (including family structures, place of residence, school),
 - develop possible courses of action for the use and protection of spaces
- Promotion through activity:
- Discussion about food waste in their own lives compared to other countries in the EU
 - Developing shared rules for a food-sharing shelf
 - Developing possible courses of action in the school context

8. Technology, digital technologies, and work

Expected competencies:

Students...

- find solutions to simple technical tasks, plan and carry out their implementation
- create and use simple model drawings to build their models
- use common (including digital) tools and materials appropriately and safely,

Promotion through activities:

- Planning and designing a food-sharing shelf for the school
- Designing signs (rules, usage, sorting)
- Reflection on functionality, placement, and use in everyday school life

Interdisciplinary perspective:

- Education for sustainable development

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- Consumer education
- Media literacy (use of digital tools for data analysis)
- Democracy education (participatory decision-making)

Teaching approaches and learning strategies/theories

Key elements of inquiry-based and problem-based learning are clearly incorporated into the lesson. Students begin with an open-ended question: namely, in which area does a particularly large amount of food waste occur? This question is explored using real-world data sets, which students read, compare, and interpret. The focus is not merely on applying mathematical methods, but on understanding data as the basis for insights into a real-world situation. Data analysis thus serves as a means of exploring and reflecting on the problem. Students formulate explanations for striking results and relate these to their own daily lives. In this sense, working with data is understood as part of data literacy, which goes beyond purely statistical skills and encompasses social significance.

Furthermore, the lesson plan exhibits clear characteristics of project-based learning. Engaging with the problem does not result in a purely theoretical exercise, but leads to a shared goal pursued over several hours: the development of a food-sharing shelf for the school. This project combines analysis, planning, and implementation, enabling students to translate their insights into concrete action. The project is designed to be realistic and has potential benefits beyond the classroom, as it is geared toward the school community. This allows students to experience learning as a meaningful process in which their own actions can make a difference.

Another key aspect of the lesson is learning through design. During the design phase, students develop ideas for the practical implementation of the food-sharing shelf. Together, they consider where a suitable location might be, what rules are necessary, and how these can be communicated clearly. The design process encourages learners to put themselves in others' shoes and make functional and design decisions. Creativity and imagination are not viewed as add-ons, but as essential components of problem-solving.

Collaborative learning runs as a consistent principle throughout the entire lesson unit. Students work together to analyze the data, share observations, discuss possible causes, and develop solutions for the joint project in groups. Communication, cooperation, and the negotiation of rules are central components of the learning process. This fosters not only subject-specific but also cross-curricular competencies such as teamwork, communication skills, and a sense of responsibility.

With regard to civic engagement and social justice, this lesson unit deliberately addresses the issue of food waste within the national and school contexts. Students explore what a community-minded approach to food might look like within their own community. The food-sharing shelf is seen as a concrete contribution aimed at a more equitable use of available resources and at fostering a sense of responsibility for collective action.

In summary, it can be noted that the focus of the lesson unit lies primarily on problem-based, project-oriented learning as well as learning through design. Inquiry-based learning is particularly prominent in the data-based analysis phase, while game-based or adaptive learning plays a secondary role. The deliberate selection of these approaches allows for a clear focus and supports the goal of meaningfully combining data work, social responsibility, and creative action without overloading the lesson unit methodologically.

Educational Scenario planification

Lesson plan

	Lesson Description	Description of the activity	Material	Social form	Time
Lesson 1+2	Introduction: Greeting Visual prompt, gathering initial ideas	Image is shown, Opening question: “What foods have you thrown away recently, or seen being thrown away?” The students’ ideas and prior knowledge are gathered Students illustrate what kinds of food are thrown away in private households.	Image showing food waste from private households		5 min

	Introduction to the topic: In which areas is how much food ? How can we determine this?	Vote: Where is the most food thrown away? At home, in supermarkets, or in restaurants? From the students' comments, it becomes clear that they, for example, have sometimes thrown food away in a restaurant; this leads to a new question. "In which areas of life is the most food thrown away?"			5 min
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		A class vote is held, and the results for each term are written on the board. This should then be verified by analyzing the data.			
Data set in Codap: Introduction to using Codap	Board display Important Codap functions are explained	Board display (Appendix 2)			10 min
Data set in Codap: Reading the Data	Worksheet Key questions regarding the dataset in relation to "Reading the Data" are answered In pairs Basic information about the dataset (displayed on the wall) is discussed in a whole-class session Students should then determine in which areas the most waste is generated on average	Worksheets (Appendix 3), iPads with Codap data			15-20 min
Data set in Codap: Reading Between the Data	Conducted in group work Each group works on one sector's worksheet A bar chart of the respective sector (y-axis) and the countries (x-axis) is created in Codap. (Appendix 4) The arithmetic mean for each sector is calculated and plotted on the graph using screenshots	Worksheets (Appendix 5) iPads with Codap data			15 min

	Recording results	Results are compiled in a plenary session: The arithmetic means of the individual sectors are transferred to a new bar chart. Average values for European countries	Bar chart on the whiteboard (Appendix 6)		15 min
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		across all sectors can be identified. Values are compared with one another What should be considered when scaling? Answering the key question: “In which areas of life is the most food thrown away?” → Most food is thrown away at home (private households). A new question arises: “Why is that the case (reading beyond the data), and what exactly gets thrown away?”			
	Food waste in private households	Board display Pie chart: What gets thrown away most at home? Spontaneous comments from students are discussed → Fruit and vegetables are thrown away the most Final reflection Why is that? Question arises: “What can we do about this at school?”	Pie chart (Appendix 7)		15 min

Lesson 3+4	Introduction: Greeting Engagement through visual prompt	Visual prompt: Students are shown images of trash cans filled with food and rescued food, as well as food-sharing shelves Discussion questions: What do you see? How does that make you feel? Who has experienced something like this in their daily	Introductory images (of food scraps in trash cans, saved food, food-sharing shelf) Illustration of the diagram created in Lesson 1C2 (Appendix 8)	Class discussion in plenary	15 min
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		life? Why is food thrown away even though it's still good? What topic could we explore in this lesson? Refer back to the diagram -> Show the diagram again and review what was observed there (Master Trash in private households) Formulating the lesson topic/question: What topic emerges from our mathematical findings from the last few lessons and the photos you see? → How can we share excess food in a meaningful way instead of throwing it away?			
	In-depth discussion: - What is food sharing?	Developing the content: Watch a video about food rescue together Observation task using a worksheet: What does the video show? Key insights about food sharing are recorded (understanding the content) Why is this important? Based on the video content, but also on personal experiences if applicable (clarify the significance of food sharing) What does this have to do with me? What do I throw away in my daily life, etc.? (Make the transfer)	Video: https://www.youtube.com/watch?v=fzHwmo9yQNI Worksheet: Food rescue and food sharing (Video observation assignment) (Appendix 9)		15 min

	Introduction to the food-sharing shelf	Group discussion in plenary: Record the key findings from the worksheet Highlight the societal and social significance of food sharing Introduction to the school-wide project: We see that we, too, throw away food at home. We want to work together here to counteract this through food sharing. To that end, we want to develop a school-wide project: We are setting up a food-sharing shelf at our school.			5 min
	Brainstorming through a gallery walk	Four large posters are hung in the classroom with the following questions: Where could the shelf be placed? Who will bring the food? Who takes the food? Which foods are suitable for the shelf? The students move in groups from poster to poster and jot down their ideas (2–3 minutes per poster). The teacher highlights commonalities, and it becomes clear: The wide variety of ideas shows that we need to reach an agreement, hence we will now work together on the rules for our food-sharing shelf	posters (Appendix 10)		15 min

Lesson 5	Rule development: - What rules must be in place? (Student participation and involvement in formulating the rules)	Joint completion of the worksheet for brainstorming Developing rules relevant to the food-sharing shelf at the school	Worksheet: Rules for the Food Sharing Shelf (Appendix 11)	Group work (3–4 students per group)	20 min
	Discussion and reflection	Discussion of the worksheet and the group results Based on the results: Compile all rules for the food-sharing shelf into a single document (by the class) -> thus creating consistent and visible rules that everyone knows and can use to continue working in Lesson 5 Jointly establishing the core rules for the food-sharing shelf	Template for compiling the rules (Appendix 12)		15 min
	Review: Consolidation	Review of the rule collection from Lesson 4: According to our rules, what foods are allowed on the shelf? Present these rules as the basis for the lesson State the question for the lesson: How can we design our food-sharing shelf so that everyone can use it properly? → To answer this question, we will be designing images and posters today			5 min

	Design phase	The students put the previously developed rules into practice by dividing up the work to design signs and	Group-specific worksheets (Appendix 13)		30 min
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		informational materials for the food-sharing shelf. The class is divided into three working groups: - Sorting signs - Rule signs - Information posters → Each group works on a clearly defined assignment and receives the necessary materials. The teacher supports the groups.			
	Conclusion	Brief presentation of the results from each of the three groups Feedback on the materials created			10 min

Timing

The lesson unit is designed to be interdisciplinary and comprises a total of five class periods. In the first two periods, the focus is on mathematics, particularly on the analysis and presentation of data on food waste. At the same time, social issues are already incorporated into the discussion, as the data is embedded in a context relevant to everyday life.

The third and fourth class periods are primarily assigned to the social studies and general studies areas. Building on the mathematical results, students explore the topic of food waste and food sharing. Mathematical connections are maintained throughout, for example by referring back to previously created diagrams.

The fifth lesson is dedicated to art class and focuses on the creative implementation of the project. Here, too, content from the other subjects is incorporated, as the design of the signs and posters is based on the previously developed rules and insights. Overall, due to its project-oriented nature, the lesson unit cannot be strictly assigned to individual subjects; rather, each lesson has a subject-specific focus, while influences from the other participating subjects are always present.

Teaching and Learning Materials

Lessons 1 and 2:

The lesson begins with a visual prompt to introduce the topic. Building on this, a dataset in Codap is used, which the students are expected to understand with the help of a worksheet (Appendix 3). To this end, the basic functions of Codap are first explained using a board

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diagram (Appendix 2). To adequately answer the lesson's central question, students work in

groups to create a bar chart for a specific sector, calculate the arithmetic mean using the worksheet, and analyze their chart (Appendix 4 C 5). The results are consolidated using a jointly created chart of all calculated average values (Appendix 6). This chart shows that private households produce the most food waste on average; to analyze this further, a pie chart is discussed, in which the various types of waste from private households can be identified (Appendix 7).

Lessons 3 and 4:

The lesson begins with visual prompts showing food waste in trash cans as well as rescued food and food-sharing shelves (Appendix 8). In addition, the diagram on food waste in various sectors created in previous lessons is revisited, and a projector is used to present the technical Ensure a connection to the topic (Appendix 6). To explore the topic in greater depth, a video on food rescue is shown to the class. Students engage with the video using a structured worksheet that includes tasks designed to promote understanding of the content, the social significance of food sharing, and reflection on their own consumption habits (Appendix 9). To generate ideas for the school food-sharing shelf, large-format posters are used; these are hung in the classroom and contain guiding questions regarding the use of the shelf (Appendix 10). The subsequent development of rules is supported by another worksheet that, among other things, incorporates the familiar pie chart and guides students to identify appropriate food groups and formulate basic rules regarding the condition, packaging, and handling of the shelf. Results are collected on a prepared template and displayed for all to see (Appendix 11 C12).

Lesson 5:

Lesson 5 focuses on the practical implementation and creative development of the food-sharing project. The rules established together in Lesson 4 on the template serve as the basis; these are displayed at the beginning of the lesson using a document camera or a photo projected via the projector. The key question for the lesson is also written on the board. For the design phase, students work with group-specific worksheets, each of which contains clear instructions and requirements for the products to be created (Appendix 13). Depending on the group, materials are used to design sorting labels, rule signs, or an informational poster. These include, among other things, paper, construction paper, pens, and, if necessary, templates or examples of pictograms and signs. The groups' results are presented at the end of the lesson and serve as the basis for the specific setup of the food-sharing shelf in the school building.

Assessment

The mathematical learning objectives of the lesson unit could be assessed through a learning objective assessment in which students independently create a graph based on a new, unfamiliar dataset (e.g., regarding water or energy consumption in everyday life) and analyze it. Using structured tasks at the levels of Reading the Data, Reading Between the Data, and Reading Beyond the Data, they demonstrate that they can correctly represent data, compare values, and describe anomalies. Furthermore, they derive

simple conclusions or possible courses of action from the presented data and justify these based on the graph.

The content-specific learning objectives of Lessons 3 and 4 could be further assessed through brief reflection and application tasks. In these tasks, students explain the concept of food sharing in their own words, describe the sources of food waste in their own environment, and justify under what conditions food can be shared. In a follow-up task, they formulate concrete courses of action to reduce food waste. In this way, it is assessed whether they can recognize social contexts, evaluate them responsibly, and develop sustainable approaches to action, while the competency of deriving actions from data — practiced in mathematics class—is deepened in terms of content.

Annex