Deliverable 4.3

SOCIAL NORMS-FOCUSED SCIENCE EDUCATION PACKAGE

CHORIZO PROJECT

D4.3

Social norms-focused Science Educational Package

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Glossary of terms and acronyms

Acronym/Term	Description
0FLW	Zero Food Loss & Waste
CA	Consortium Agreement
CSs	Case Studies
EU	European Union
FW	Food Waste
FLW	Food Loss and Waste
MOA	Motivation-Opportunity-Ability
SEP	Science Educational Package
SN	Social Norms
WP	Work Package

Executive summary

The CHORIZO Project aims to explore the role of social norms in influencing behaviours related to food waste generation, and to develop educational tools that promote behavioural change among school pupils. The project seeks to create a **Science Educational Package (SEP)** designed to create learning about food waste, its environmental and social impacts, and to foster responsible habits through **gamified learning methods** among young people in school settings.

The development of the SEP involved a **multi-phase approach**, beginning with a review of case studies to identify behaviours and social influences on food waste among pupils. Two **Living Labs in Danish schools** served as cases and **innovation hubs for co-creation workshops** involving **researchers, pupils, and mentors/industry partners**. The co-creation resulted in a range of ideas that was further investigated in relation to the opportunities for classroom activities and activities related to the existing food service. Based on an assessment of the ideas and their ability to fit into the diversity of European school food and learning cultures two SEP ideas were chosen for further development: ***"An educational board game against food waste"*** and the ***"Hack Your School Food"***. After thorough development and refinement in cooperation with the Living Labs and with the Chorizo partners the effectiveness of the final versions of the packages was evaluated through **surveys and qualitative feedback** from students and teachers in **Denmark, Germany, Austria, and Spain.**

The feedback regarding the board game indicated users found it engaging and relevant, and contributing effectively to raising awareness of food waste. Areas for improvement included **simplifying language and enhancing the visual appeal**. The *"Hack Your School Food"* initiative was considered valuable but required contextual adaptation to the different educational environments that exist across Europe. Overall, according to the feedback both packages demonstrated **potential for promoting behavioural change** regarding food waste, although they necessitated iterative refinements based on user feedback.

The activity demonstrates clearly that it is possible to develop material on food waste literacy to be integrated in the teaching at European schools and that it's possible to make it relevant also to the existing school food service cultures that exist in European countries. The project highlights the importance of **integrating behavioural science into the didactics of such teaching**. The SEP activity shows that it is possible to develop educational materials targeted *"out of subject"* project-based learning environments and that it can target more subjects in the school curricula. The activity also shows that is possible to develop learning materials that reaches out to food waste behaviours in families thereby making it relevant to **the daily life experiences** of pupils. Furthermore, the activity demonstrates that it is important to develop teaching materials that fit into the increasingly digitalized learning environments of modern schools. By **developing gamified, user-centred educational resources**, the CHORIZO Project contributes to offering innovative strategies for fostering sustainable behaviours related to food consumption in school settings, ultimately working towards the broader goal of reducing food waste.

1 INTRODUCTION

1.1 Project description

The CHORIZO Project ("Changing practices and Habits through Open, Responsible, and social Innovation towards ZerO food waste") is a Horizon Europe, European Union (EU) funded project, which aims to improve the understanding about how social norms (rules and expectations that are socially enforced) influence behaviour related to food waste generation[1]. Behaviour change is a critical aspect of addressing **food loss and waste (FLW)** challenges as it is the result of **multiple and interconnected behaviours** taking place at different moments and stages of the food supply chain. To significantly accelerate progress towards zero food waste, CHORIZO aimed to use this knowledge to increase the effectiveness of decision-making and engagement of food chain actors in changing social norms towards zero food waste. To achieve its aim, the project delved deep into evidence extraction through quantitative and qualitative data collection from the existing actors' whose action creates social norms & FLW behaviours. The activities were carried out as planned shown in Figure 1.

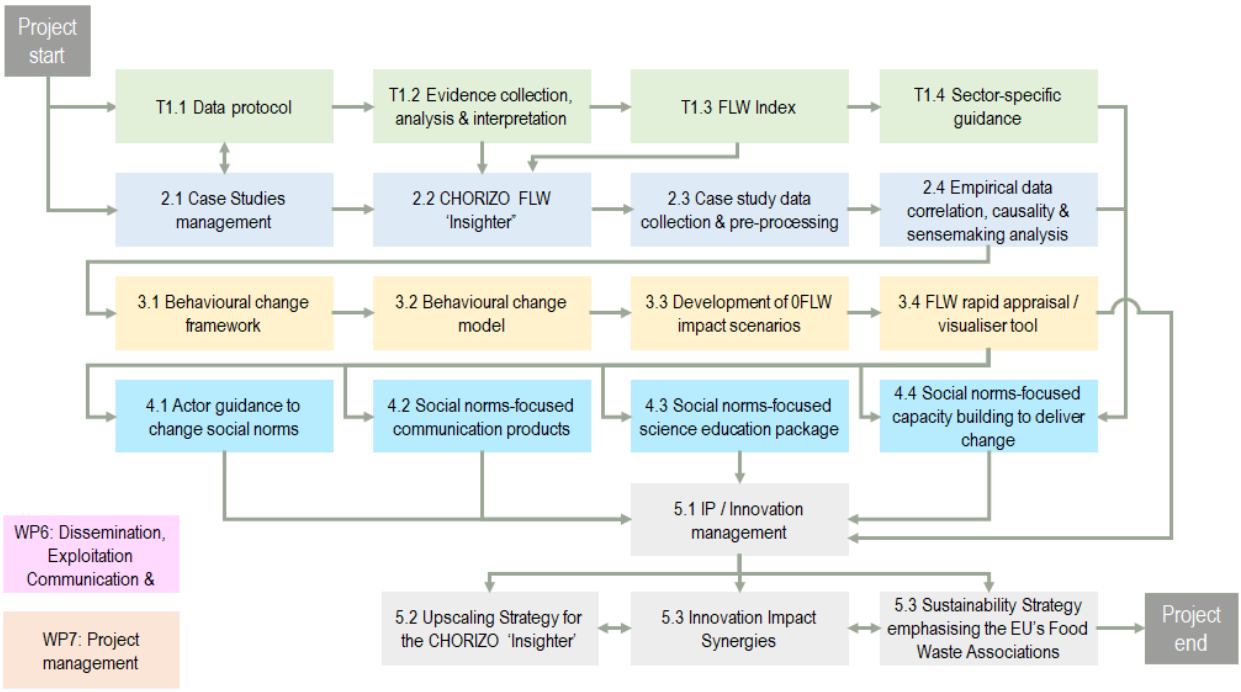


Figure 1 Interrelations between the different work components[2]

Hence, the CHORIZO project embedded these research results into the development of innovative products and services that has the ability to foster change of FLW-related social norms. The Science Education Package approach is such an example. These packages were developed based on the CHORIZO's real-life Case Studies (CSs) by interlinking information and data on the context and impact of previous FLW prevention/reduction actions undertaken by the Case Study members. This enriched the evidence-based analysis on previous FLW actions and generated new evidence on the interaction between social norms, behaviour and FW.

[1] CHORIZO Project Grant agreement 101060014-Changing practice and Habits through open, Responsible and social innovation towards Zero food waste

[2] Source: CHORIZO Project Deliverable 2.1-Case Studies Strategic Plan

1.2 Overview of tasks for change fostering science educational package

A Science Educational Package (SEP) is aimed at **teaching social norms around food waste** to school pupils using a combination of a structured set of **learning tools and scientific knowledge** targeted **ethical and behavioural education**. The SEP approach is assisting children in understanding the environmental and social impacts of food waste and is based **on hands-on experiments** and activities and **storytelling** and with the element of fun, **entertainment and gamification**. Furthermore, by integrating topics like food systems, climate and sustainability, and by paying attention to empathy and social awareness the SEP approach is aimed at encouraging responsible habits and fosters a **sense of shared responsibility** for the climate and sustainability. The SEP aims to achieve that through the inclusion of tools for reflection, family engagement, and peer collaboration to reinforce positive social norms and long-term behavioural change.

The goal of this work is to turn insights from behavioural science investigated as case study of the CHORIZO project into practical actions that help reduce food waste. This involves understanding what motivates young people, what opportunities they have to act, and what skills or resources they need. As described in *section 1.1 Project description*, the tailored Science Educational Packages was developed to help school children in changing their habits around food waste. We aim to improve **how food waste messages are communicated**, especially in schools, to make them more engaging and effective.

An important part of the work involved **designing and testing** a science education program focused on food waste in Danish schools and two other EU countries. The students worked with **mentors to create digital tools** and science-based that can be integrated into subjects like math, biology, chemistry, physics, and home economics. The program produced prototype of science educational packages with the support of external experts including CHORIZO partners with their expertise. The SEP was tested not only in Danish schools, but also in two other countries, selected by a partner organization. Finally it's effectiveness was evaluated using both surveys and interviews with pupils and teachers.

1.2.1 Objectives

Against backdrop of findings from the CHORIZO case study results conducted in two Danish schools and continuous feedback from CHORIZO project partners, the following research objective have been formulated:

- To **design and develop game-**based Science Educational Packages that engage young people with scientific concepts related to food waste and promote behavioural change of associated social norms.
- To **investigate and validate the effectiveness** of Science Educational Packages in promoting social norms and responsible behaviours related to food waste among young pupils in school.

2 METHODOLOGY

2.1 Review and reflection of Case study findings

Case Study 4 *"School food waste and relation with obesity and malnutrition"* of the CHORIZO project utilized in-depth interviews to create insight based on the collection of **qualitative data** on food waste-related **behaviours, motivations, and social norms among pupils, parents, and educators**. The findings underscore a pressing need for the development of food waste literacy among young people and to do that using digital approaches adapted to the contemporary learning environments of school. This was the point of departure for developing a gamified Science Educational Package aimed at addressing food waste behaviours in school settings. Although pupils according to the case finding demonstrated **awareness of the environmental and economic consequences** of food waste, their actions were predominantly influenced by **personal sensory preferences, peer dynamics, and a lack of open communication with parents**. Specifically, pupils often discard food based on **taste, texture, and freshness**, with **social acceptance** playing a critical role in their decision-making. Health and sustainability considerations were secondary to these immediate sensory and social factors.

A significant barrier identified was the absence of a food related feedback loop between pupils and parents. Many pupils refrained from expressing their dislikes for certain lunchbox items out of fear of disappointing their parents, leading to covert food disposal and missed opportunities for behavioural correction. Additionally, the school lunch environment was found to be insufficiently structured to support positive eating behaviours, lacking both social engagement and tailored educational interventions.

Integrating gamification into learning approaches presents a promising strategy to address these challenges by making food education more engaging, interactive, and relatable. Game-based learning has been shown to enhance student engagement and learning outcomes, particularly in science education (Santos et al., 2024). Cooperative games, in particular, has been shown to have the ability to foster positive emotional experiences and reduce negative responses (Chen et al., 2020). Furthermore, emotional disequilibrium—arising from a mix of positive and negative emotions—has been linked to deeper cognitive engagement and improved long-term retention (Cheng et al., 2020).

In the context of food waste and sustainable nutrition, gamified interventions have demonstrated effectiveness in promoting behavioural change. Soma et al. (2020) reported that **gamified approaches outperformed traditional methods,** with participants showing greater awareness and generating less edible food waste. Moreover, Berger (2019) highlighted the impact of social norm-based feedback mechanisms—such as the "GreenMeter"—in influencing eco-friendly food purchasing decisions, particularly when injunctive norms and social comparison were employed.

Taken together, these findings support the integration of gamification into science education as a means to bridge the gap between awareness and action. By incorporating **principles of commensality**, **feedback, and playful learning**, a gamified educational package can foster healthier and more sustainable food behaviours among pupils, while also **engaging parents and educators in the process**.

2.2 Selection and delimitation of the Science educational Package (SEP)

The process of task establishment and setting of the scope started in the General Assembly (GA) in Oslo, May 2024 using a workshop format where the CHORIZO partners provided input to the process and the ideas of creating Sciences Educational Packages in collaboration with schools, students and teachers. The workshop provided the framework for the working process on specified the goals. Based on this, the development of the Science Educational Package began with idea creation of two

school-based Living Labs, that could be instrumental in fostering innovation through collaboration between teachers, researchers, and a programmer. A project group was formed to guide the process, working closely with an EdTech publisher to ensure pedagogical and technical quality and relevance. A demo website was created as the central platform for the development of ideas for materials following an **Agile project development principle**. The basic idea was to use **iterations and fast prototyping** in cooperation with **teachers and mentors**. All work was conducted in Danish. Later on, a selection process followed as mentioned earlier. The two packages' children chose was then translated to English to ensure broader accessibility. The package was tested across three countries—Germany, Denmark, and Sweden—allowing for valuable cross-cultural feedback, adaption and refinement.

Based on the feedback, the following learning goals were formulated for the SEP's to be developed, focusing on how to make it a young people centred, engaging and inquiry-based learning approach:

- To discover how discursive action and working together can help reduce food waste.
- To learn how to choose and prepare food sustainably by understanding its nutritional value.
- To explore how digital tools, math, and science can be used to create smart solutions for food waste.
- To learn how changing school recipes can make meals more sustainable and reduce waste.
- To understand how our habits and what others us do around can influence how much food we waste.
- To learn how leftover food can be repurposed or shared through food banks to help others and reduce waste.

The learning goals came to act as the guiding principles in delimitation and selection of the SEP work and to safeguard that the design and the didactics were useful for schools and students. The two SEP selected to work further were *1) An Educational board game against food waste 2) Hack your school food*. The SEP are described and presented in Section 3.

2.3 SEP design process

The design of the Science Educational Package (SEP) was guided by the **Living Lab methodology, emphasizing real-life, user-centred co-creation.** This approach brought together school pupils, researchers, and an industry partner to collaboratively develop learning tools within the school environment using a mentorship approach. Two Living Labs were established at elementary schools—Læringshuset and Lindevang—both partners in the CHORIZO project through UCPH. These labs served as innovation spaces where students acted as co-developers, supported by researchers and mentors from the EdTech industry. The process included a series of co-creation workshops, where various tools, templates, and digital platforms were used to facilitate idea generation, prototyping, and testing. The Læringshuset Living Lab, part of the Nærheden Local Learning & Living Lab, is further detailed here[3] (Nærheden Local Learning & Living Lab). Figure 2 shows the students testing the first version of *"An educational Board game against food waste".*

[3] https://cities2030-community.gisai.eu/labs/page/52-welcome-page/

Figure 2 Testing of Boardgame in school

2.4 Validation of SEP

The validation of the Science Education Packages was carried out in two phases. In the first phase, the SEP were taken to the project GA in Bologna, where feedback on design aspects and relevancy of its content was collected from project partners and experts. This feedback was then incorporated into the SEP work. Once the refined version of SEP was designed and developed, they were ready to be tested in real life settings. In the second phase, the completed design was tested with students in Denmark, as well as students from Germany, Austria, and Spain. The feedback process involved both students and teachers, ensuring a comprehensive evaluation of the materials through survey and qualitative written feedback.

2.4.1 Summary of first phase feedback, "Bologna GA, February 2025"

The feedback were obtained in a interactive session through the software package "*Sendsteps*" integrated in a slide deck after the participants had an opportunities to digest the SEP materials.

2.4.1.1 Feedback for Boardgame

The feedback highlighted that the board game was widely seen as a relevant and engaging educational tool for raising awareness about food waste among young people at school. Many respondents appreciated its interactive and participatory nature, noting that it could make learning about food loss and waste (FLW) more fun and accessible, especially for children around the age of 12. The reflection cards and level-based gameplay were particularly praised for their ability to encourage deeper thinking and repeated play. While most comments were positive, a few obstacles were mentioned as well. It was suggested that the game could benefit from more focus on food waste specifically, rather than broader food production issues, and additional incentives to enhance replay ability. Overall, the board game was considered a creative and effective approach to introducing FLW topics in educational settings.

To enhance the BoardGame and better address social norms related to food waste, several suggestions were made. These included introducing difficulty levels tailored to different age groups and ensuring questions are age-appropriate, especially for younger players. The suggestions also

proposed that the game could benefit from a mix of collaborative and competitive modes, with options for rewards and humorous consequences to increase engagement. Furthermore suggestions included adding an hourglass to time reflection card discussions and incorporating a third "action" category could help maintain a dynamic pace. Visual elements like images of food waste and clearer colour coding for reflection tasks were also recommended. Content-wise, it was suggested that the game should include questions that prompt students to reflect on their own behaviours and attitudes, promote positive actions, and emphasize social responsibility.

The feedback suggested a wide range of relevant and enriching questions that could be added to the board game's "*Question Cards*", *"Reflection card"* to deepen engagement and learning around food waste. Many responses emphasize the importance of local and seasonal food, storage practices, and date marking, linking these to both environmental and health aspects. There's a strong interest in social norms, gender perspectives, and country-specific habits, including comparisons across Europe and the influence of social media to be included. Suggestions also include making questions more age-appropriate and concrete, such as asking why food is wasted rather than how much, and incorporating definitions to clarify complex concepts like climate and norms. Several comments recommend integrating CHORIZO project data and outputs to enhance relevance and accuracy. Overall, the feedback encourages a mix of personal reflection, practical knowledge, and cultural context to make the game more educational and relatable.

2.4.1.2 Feedback for Hack Your School food

The feedback indicated that the Hack Your School Food had generally been seen as **highly relevant and useful**, particularly in supporting multidisciplinary learning and helping teachers facilitate workshops with ready-to-use materials. Many respondents found it valuable for raising awareness about food waste among children, especially in contexts where lunch preparation was done at home. However, **its relevance is considered varied** across countries due to different school lunch systems—in places like **Spain, Greece, Italy, and Slovenia**, where schools or canteens provided meals, the pack had been considered less applicable. Overall, the SEP has been viewed as a valuable tool, with potential for greater impact through local adaptation and broader stakeholder engagement. The feedback has also offered several creative and practical ideas to enhance the Hack Your School food SEP by more effectively addressing social norms related to food waste. A key theme is the importance of contextualizing social norms—**adapting them to the specific country, age group, or political environment.** Ideas such as children designing their own lunch boxes or weekly menus, cooking classes, and seasonal meal planning is seen as an engaging ways to promote reflection on habits. There has been interest in adding content about school-provided lunches, and using examples and communication strategies that naturally introduced social norms. Some feedback encouraged integrating CHORIZO project insights and offering capacity training for teachers to deepen understanding. Overall, the suggestions aimed to make the SEP more interactive, inclusive, and tailored to real-life behaviours and social influences.

2.4.2 Summary of second phase feedback "Pupils and Teachers"

Due to the constraints imposed by the school summer holidays, busy school period of exam and school start, and the extensive time required to fully implement and complete the intended learning objectives, only one Science Educational Package (SEP)—An Educational Board Game Against Food Waste—was carried out during the second phase of the project. This SEP was selected for continued testing and refinement, allowing for focused evaluation and integration of feedback from both students and educators.

2.4.2.1 Educational Board Game survey and comments analysis

The survey was responded by 34 students and 7 teachers from Denmark, Germany, Austria, and Spain. The responses were collected hand-in paper. The qualitative feedback was communicated through emails.

The students feedback reflected a **mix of positive and critical responses**. Overall, the feedback suggests the game was **accessible, appropriately challenging, and enjoyable** *(see Figures 3-6*). Many participants appreciated the game's educational value, noting that they **learned about food waste, nutrition, and conscious food handling**. The game was described as **fun and engaging** *(see Figures 5-6)*, especially when played with the right group, and it sparked meaningful conversations among students.

However, several comments pointed out areas for improvement. Some found **the language and questions too complex**, especially for younger children, and suggested using simpler wording and clearer visuals. Others mentioned that the game could be boring or confusing, with rules needing more explanation and figures not fitting well on the board. Suggestions included adding **more action cards**, **laminating them, diversifying question difficulty, and making the game more visually appealing**.

There were also remarks about **cultural and contextual relevance**, such as adapting the game to different age groups or school systems. Overall, while the game was seen as a valuable learning tool, the feedback highlighted the need for better **accessibility, clearer design, and more engaging content.**

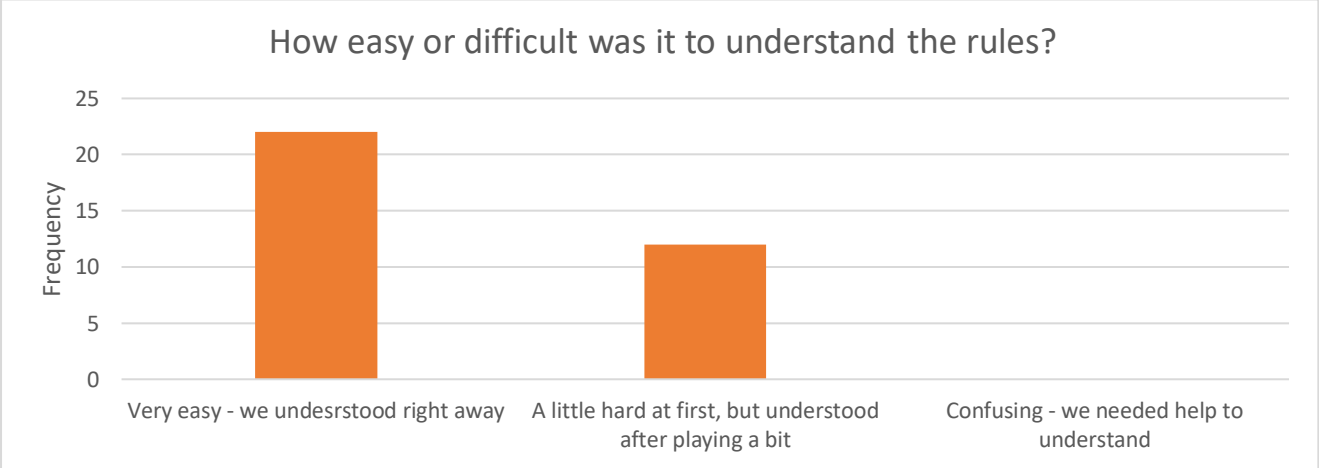


Figure 3 How easy or difficult was it to understand the rules?

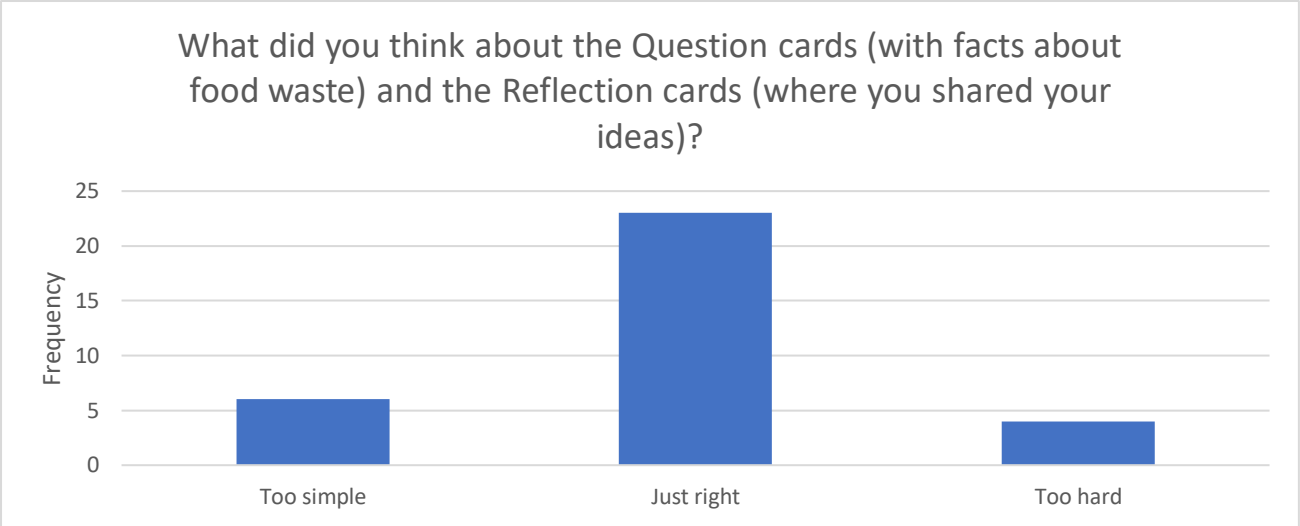


Figure 4 What did you think about the Question cards and the reflection cards?

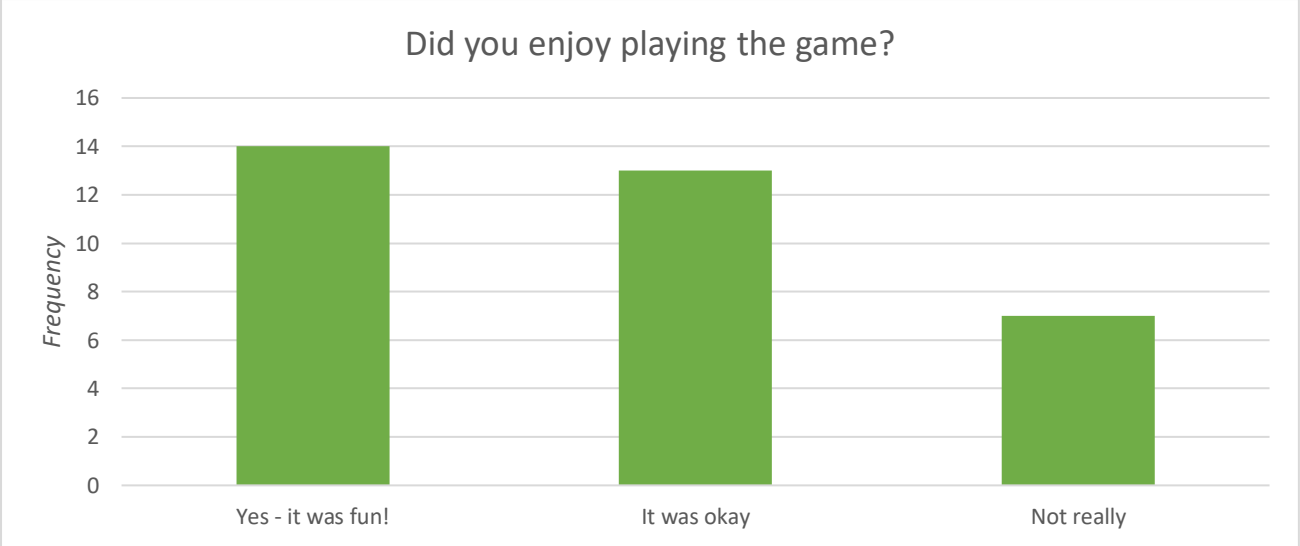


Figure 5 Did you enjoy playing the game?

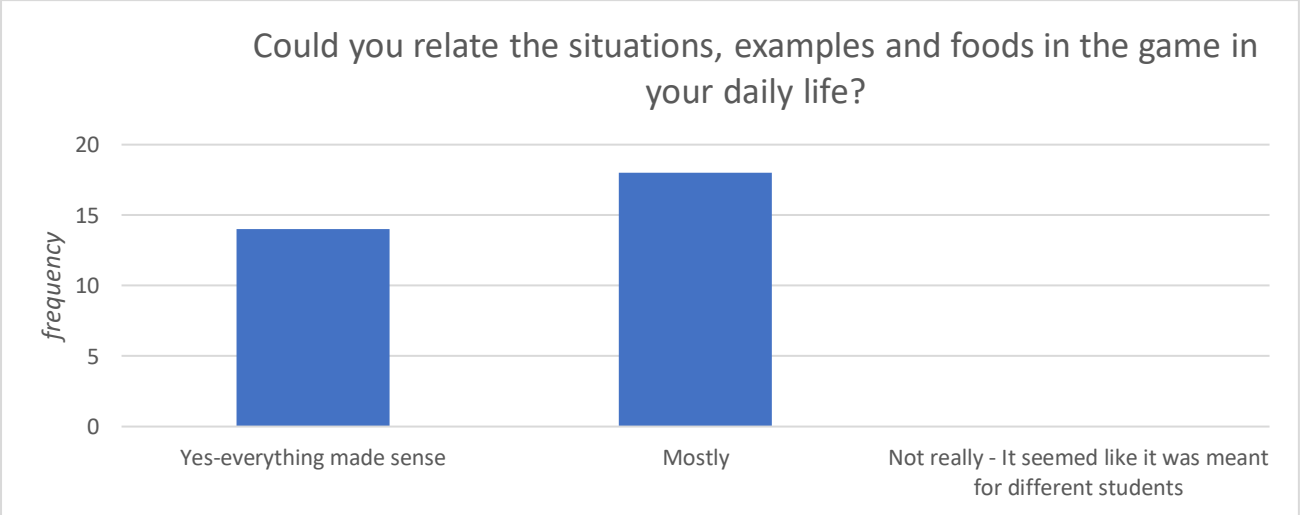


Figure 6 Could you relate the situations, examples and foods in the game in your daily life?

Horizon Europe

The teachers generally found the game's **content appropriate and relevant to the topic of food waste**, although some noted minor mismatches—such as difficulty in assigning subjective **values like "cool" or "uncool**" to certain food items. Engagement levels were moderate, and the game was seen as effective in raising awareness and encouraging reflection, especially when teachers adapted it to better suit their classroom context. However, a few teachers felt that some examples or topics were too complex or less relatable for their students, suggesting the need to tailor content more carefully to different age groups or learning levels.

The game was tested in classrooms of 20–25 students, played in teams with the board projected for visibility. While this setup worked, organizing six teams proved logistically challenging. Additionally, the game's length was a concern—no class managed to complete it, particularly when played in teams, which extended the duration. Teachers recommended **shortening the board** to ensure the game can be completed within a single session, making the experience more satisfying and manageable.

Teacher involvement was highlighted as essential, especially in primary school settings, to guide and facilitate gameplay. The debate boxes were seen as too time-consuming and often left unfinished. A more dynamic format was suggested, such as role-playing scenarios followed by solution proposals, to keep the game engaging and agile. Finally, teachers recommended incorporating positive reinforcement—like rewarding good behaviour with board advancement or peer applause—to balance the punitive elements and enhance motivation. Overall, the game was well-received, with students showing interest and enjoyment, and the feedback provided several constructive ideas for improvement.

3 SCIENCE EDUCATIONAL PACKAGE

The following sections provide a detailed overview of the two Science Educational Packages (SEPs), which represent the finalized versions developed after integrating feedback from the second phase of testing with students and teachers. These packages are designed to be practical and accessible, offering downloadable materials that educators can readily implement in their classrooms.

3.1 An educational Board Game against Food Waste

Subjects/Themes included: Impact of food waste on environment; Land and resource use; Food transportation from production to consumption; Economy; Healthy food as a nutritional; National and global inequalities; Social behaviour around food waste, Healthy vs unhealthy food, Social interaction
Language: English 
Can be used in project-based learning (out of subject teaching): Yes
Hours required (total): 45 to 60 minutes of playing
Number of sessions: Minimum 1
Developed & tested by: Michala Hvidt Breengaard, Mukti R. Chapagain, Subash Rana & Lis Zacho and 6th grade pupils an educational board game "FOOD WASTE" is developed by Michala Hvidt Breengaard, Mukti Ram Chapagain, Bent Egberg Mikkelsen and Subash Rana in collaboration with CHORIZO Project partner, ICLEI.
The game was tested and validated by Lis Zacho together with 6th grade students from Lindevangskolen, Denmark; Verbraucherzentrale Bremen e.V. and Oberschule Rockwinkel from Bremen, Germany; Hannah Tögel, All-day Primary School Campus Donaufeld from Vienna, Austria; and Victor Roda, Juan de Lanuza School and Mensa Civica from Zaragoza, Spain.

3.1.1 Introduction - why this topic is important

This board game on food waste aims to increase knowledge about food waste as well as to translate knowledge into action. The game is educative in its way of informing about food waste and drawing attention to how social norms and individual behaviour take part in the global problem of wasting food. In doing so, the game aims to bring knowledge and action closer together. The game is based on data from the CHORIZO project about young people's food behaviour and attitudes as well as the social norms around food and food waste.

Food waste is a global problem and can have an impact on individual health and economy, environment, and global resources (Mokrane et al., 2023). Food waste can be linked to social behaviour around food, and social interaction between people as well as national and global inequalities. Food waste among consumers is a behavioural challenge with behaviour being acquired and developed over time and influenced by various sorts of knowledge and skills as well as social norms and ideals (Jones-Garcia et al., 2022). However, behavioural challenges can be addressed with proper action.

The school environment has a potential to influence pupils' behaviour and promote new good attitudes toward food waste. Lunch in school is eaten together with other pupils and social norms often play a crucial role in the pupils' attitude toward eating or wasting their lunches. Furthermore, what is learned in the school environment in relation to lunch consumption might influence food consumption at home and vice versa. Parents' knowledge, skills, and attitudes toward food waste have an impact on children, in the same way, children play a crucial role in bringing food waste into the family.

To put food waste on the agenda in both the school and family setting, the game is structured around various themes related to food waste and its impact on individual and planetary health, environment, and family economy. Based on the project findings, the game aims to promote the understanding and recognition of food waste in various settings and types of food. This includes:

- To make aware of social norms around food waste and their impacts
- To educate about food waste from various angles (e.g. nutrition, climate, economy)
- To promote a dialogue about food and food waste among pupils as well as between parents and children

The game particularly focuses on school and home contexts, such as lunch-packs and eating with the family. The game is designed as an activity that can be carried out in the classroom among pupils and at home with the family – representing a school-home learning tool. The game comes with questions, reflection and action cards.

3.1.2 Theory – what do we know from science?

The board game is built upon research into game-based learning. Research shows that games can provide a stronger motivation to engage in learning activities which are considered unattractive, e.g. reading textbooks or listening to presentations (Chen et al., 2020; Santos et al., 2025). Educative games seem effective in enabling involvement, responsibility, commitment and relevance in processes of learning. This learning potential applies to both physical and digital games. Learning about food waste is a subject that can benefit from gamification.

Findings from the CHORIZO project indicate a missing dialogue between children and parents as well as among pupils in relation to preference, choices and waste of lunch packs. Findings also show that the younger the pupils were, the more likely they are to eat what they brought from home or offered. Conversely, older pupils more often throw out their meals and lunch-packs. Young people´s attitude and motivation regarding the consumption or wasting their lunch-pack is influenced by peer groups and family. Pupils' likelihood of discarding their lunch-pack is largely influenced by their perceptions, preferences, and expectation regarding taste, texture, and freshness of the food item. Furthermore, pupils' individual interpretation of food quality plays a significant role. Pupils tend to be "selective and picky", favouring sweet, salty and fatty food such as hot dog, pizza, chips, chocolate bars etc. over fruits and vegetables.

The findings show a vast potential in changing behaviour in a healthier direction. A widely used model within behavioural psychology that can help to understand the processes in behavioural change is the Motivation Opportunity Ability (MOA) framework. It is a theoretical model that is applied in a lot of different areas from smoke cessation, drinking habits, organ donation, pension saving, eating habits etc. The MOA framework is about understanding the underlying mechanisms that lead to a certain behaviour, investigating the three components of Motivation, Opportunity and Ability (Vittuari et al., 2023).

Firstly, motivation is about the attitude towards a certain behaviour, the awareness of the consequences of that behaviour, and the social norms surrounding it. If you do not agree that minimizing food waste is good, it will be hard for you to start wasting less. You can think about motivation as an inner voice telling you to perform a certain action from time to time. A kind of reminder, and of course the first step towards motivation is awareness. If you know about the damage that food wastes due to the climate or the amount of biological or financial resources that go wasted in the garbage bin it is much easier to feel motivation. Additionally, individuals' behaviour is influenced by what other people do, or think it is correct to do.

Secondly, there needs to be an opportunity in the surrounding environment for acting. If you cannot get a doggy back in your favourite restaurant it will be difficult to bring leftovers back home for later consumption. And if your school canteen has a compulsory weighing of your plate waste at check out it will be much easier for the school headmaster to follow the progress of food waste mitigation actions. So, a lot of opportunities have got to do with the environment. Think about the environment as "all that is out there" as the structures in which we live our lives. So, if the food environment is dominated by a lot of minimarkets selling only Ultra Processed Foods it will be difficult for you to increase your intake of fruit and vegetables.

Thirdly, you need to have the ability to perform a given kind of behaviour. First, knowledge plays an important role. If you do not know the difference between food that is safe to eat and food that is not you are likely to end up wasting more food than needed, Shelf life and expiry dates are always determined by algorithms. That is, they are predicted based on mathematical models. So, by knowing the basic principles of preservation of foods you can save a lot on your waste account. This is what is often referred to as food literacy. Even if the individual has knowledge about how to handle food, a second crucial element is represented by skills, meaning the ability to put in practice certain actions. A good example is being able to correctly preserve food.

Having covered the opportunities and the ability the question remains. How do we best create learning? Traditionally we would read books, count on a teacher to supervise and coach us and do some homework. But learning and curricular studies have come up with a range of alternative approaches. Gamification is one of them. Gamification is usually considered as entertainment and a pastime, but you can actually get really far with games, even when the purpose is to learn and create learning outcomes. So far that a research tradition has emerged on how best to use gamification as an active element in the learning process. Gamification can help increase the students' motivation level, it can increase knowledge retention, and it can create engagement through social mechanisms such as competitions, challenges and rankings. And in the digital age, technology is of course one of the driving forces behind gamification. New screen types, fast processors and artificial intelligence are some of the technologies that have helped the development along. Data sharing is another. With this method, you can easily store and share data. Imagine that a school is playing a game where you come up with new ideas and create new results. And imagine that the school then shares or competes with another school. Then data can be reused, and a school does not necessarily have to start over every time. You can, so to speak, stand on each other's shoulders. But despite the technological innovation, old fashioned non-digital versions such as board games have not become obsolete. On the contrary – physical games such as board games have got a revival over recent years. So why not apply the gamification track to the fight against food waste?

3.1.3 Learning goals – what will pupils learn?

The overall goal of An educational board game is to create awareness and dialogue about food waste. The game does so by a mix of sharing knowledge and creating involved interaction between the players (young people as well as their family). Through playing the game, the participants will:

- Gain knowledge about food and food waste in various contexts.
- Get an increasing understanding of how they themselves contribute to food waste in different settings.
- Learn about the social aspects (social norms) around food that cause wasting food as well as the possibilities of changing norms.
- Learn about various aspects of food waste and its impact on the environment, the individual, and society.

3.1.4 Exercises & practice – how do I carry out the thing?

The board game can be played in different situations with different people:

- Pupils playing together
- Pupils playing at home with their family
- Pupils playing at school with teacher supervision

3.1.5 Materials & facilities – what do I need for the activity?

The board game contains:

- The board *(see appendix 7.2* Template of Boardgame and it's rule and regulations*)*
- Playing cards "Reflection cards; Question cards; Action cards" *(See appendix 7.3* Template of playing cards "Reflection, Action & Question"*)*
- Tokens in different colours
- Dice

A digital version will eventually be developed to be played on KaHoot using a big screen.

3.1.6 Resources & Links – where can I learn more?

Resources and Links	Description of the resource
FW-Educational-BoardGame-Board_Rule_Instructions.pdf	An Educational Board game "Food Wtaste" and it's rules and regulation.
BoardGame-Reflection-Card-BOTH-SIDES.pdf	Reflection cards of the board game.
BoardGame-Question-Card-BOTH-SIDES.pdf	Question cards of the board game.
Boardgame-Action-Card-BOTH-SIDES.pdf	Action cards of the board game.

3.2 Hack your school food

Possible Subjects: Home economics, SDGs focused activities, and STEM subjects such as Science, Math, or Design; Project-Based Learning (out of subject teaching)
Themes included: Environment and climate impact, Social and Health impacts; Food hunger; Quality perception of food; Food values and belief; Food supply chain; Media trends; Peer group influence; Food waste calculation, Date labelling on food products.
Target group: Grades 6, 7 and 8 (age 11^{+})
Hours required (total): 1-2 hours for each 3 lessons. If you want to work on "Designing a school meal" from the food donations (from food bank), please add 2 hours.
Materials and facilities needed: Room for group work, paper & writing materials

3.2.1 Background & Introduction - why is this topic important?

Food waste is one of the major challenges to the sustainability of today´s food system. Food waste behaviours can have long-term nutritional effects since healthy foods may be the ones that are

thrown away. This makes promotion of both healthy and sustainable eating habits a critical priority. Learning how food systems work, how food impact sustainability, and the consequences of food waste are all essential topics that impact directly on our everyday lives. Reducing food waste offers a powerful strategy for encouraging healthier and more sustainable eating habits, especially among young people.

Schools provide an ideal setting for this effort, as they are places where learning and food practices naturally intersect. Young people's food waste behaviour is strongly shaped by personal preferences and perceptions of food quality, as well as influenced by peer group and social norm[4] within the school environment. These personal preferences and perceptions of fruits and vegetables are often related to quality, based on taste and appearance of the food.

In the CHORIZO project[5], we explored various educational materials and strategies related to food and food waste, identifying food waste as a key topic for hands-on, project-based learning. Therefore, we know that many schools have already put food waste on their teaching agenda with themes such as food sharing, use of surplus food, cooking workshops, demonstrations, planting, and Sustainable Development Goals (SDG)[6], especially the SDG 12.3. and food related learning activities can be used for many school subjects like Science, Mathematics, Home economics and Project Based learning.

The topic of food waste is multifaceted and contains a broad range of themes that are well-suited for school activities such as: Quality (Taste, texture, freshness) perceptions; current media trends; food culture; social norms; date marking of food products; responsible consumption; nutritional and health impact, economy; social equality and environmental impact. And the good news is that reduction of food waste is something that everybody can do something about – and that can have a direct and measurable impact. Actions to reduce food waste can be quantified in terms of both saved CO2-equivalents and nutritional value. Open-sourced databases such as CONCITO[7], Frida[8] are available to calculate the climate impact and nutritional value of specific food items that are at risk of being wasted. Furthermore, since schools have close ties with families, food waste literacy created at school might easily extend into behavioural change in the home environment.

3.2.2 Learning goals - what will we learn?

The main goal of this learning activity is to increase students' knowledge about overall food systems and their knowledge and skills to reduce food waste. In other words, to provide students with actionable power to reduce waste of food and at the same time learn about social, economic and climate impacts of wasting food. The objectives of the learning activities are to:

1. Explore various social norms and important concepts around school food and food waste
2. Learn how our behaviour around food waste is formed.
3. Learn about the different causes and mitigation strategies on food waste.
4. Learn about climate and nutritional impact of wasting food.

[4] Social norms are rules and expectations about behaviours that are socially enforced so are one of the key factors that influence behaviours.
[5] CHORIZO project newsletter on " Young peoples´ behaviour toward lunch-packs" - https://chorizoproject.eu/wp-content/uploads/2025/01/Newsletter7_CHORIZOv3.pdf
[6] https://sdgs.un.org/goals
[7] https://concito.dk/en/projekter/store-klimadatabase
[8] https://frida.fooddata.dk/?lang=en

3.2.3 Learning Process - how do we organise activities?

The activity can be organized in the form of workshop. The activity is most suitable for students from 6th to 8th grade (11^{+} years old). It is recommended to divide the class into small groups of 3-5 students. To carry out this activity consider 1-2 hours for each theme (A, B & C) below. As a teacher you could supervise and guide students during the group work.

Tip: *Invite external mentors—such as university researchers, tech entrepreneurs, or local food surplus advocates—to enrich each theme with real-world insights and inspiration.*

As shown in *Figure 7*, the activity can be organized in three different workshops. Students can work in a group and reflect on what are the causes of food waste, discuss what possible solutions, and explore the various impacts related to climate, economics, social, and personal health. For the guidance of the student, you can make use of the inspirational themes and question provided as attachments.

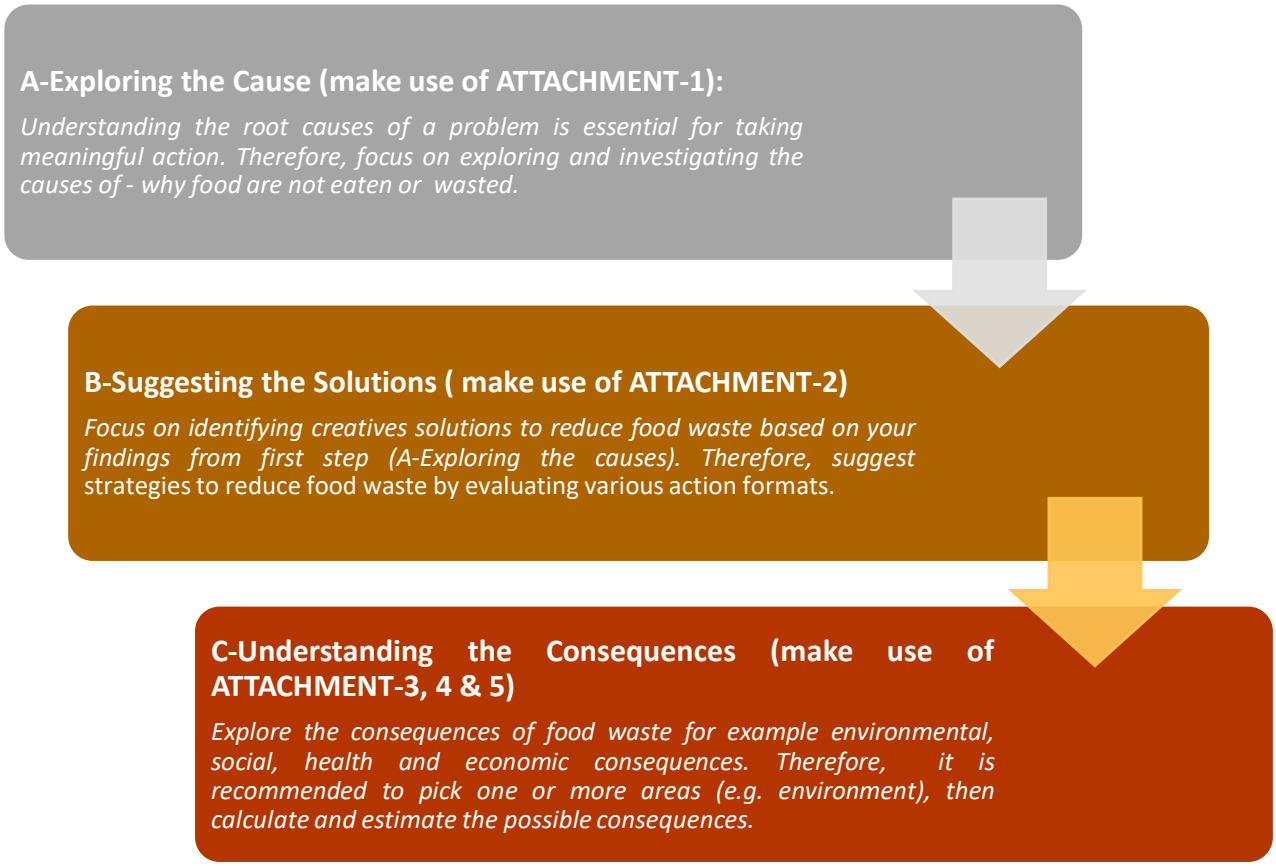


Figure 7 Three Step actions for learning Process

3.2.4 Resources & Links – where can I learn more?

Link and title	Description of the resource
Teaching_Material-on-Food_Waste-For-schools.pdf	The detail description and manual for teaching material "Hack your school food"
Climate database	Food Climate database from Denmark and useful for whole Europe
Seasonal Calendar	Platform to Explore Seasonal Fruit and Vegetables in Europe
TasteGuide (Smaguiden)	Visual guidance of the taste and taste matching of the food ingredients

Link and title	Description of the resource
Teaching_Material-on-Food_Waste-For-schools.pdf	The detail description and manual for teaching material "Hack your school food"
Food Climate Database	Database of climate impact of food items
Haver til Maver ("Gardens2Bellies")	School gardening and food waste learning activity centre
SAPERE – network for a promising educational approachhttps://www.sapere-association.com/	Taste educational resources on preferences, likes and dislikes in relation to foods and how insights can be used in school teaching
Food Educators	Learning resources for food literacy training in school settings

3.2.5 **ATTACHMENT-1:** Themes and Inspirational questions for exploring the causes of food waste (*why IS FOOD wasted?)*

To explore the cause of food waste, following themes and questions can serve as inspiration.

Themes: Quality (Taste, texture, freshness) perceptions of fruits and vegetables

- *What do you consider to be attractive to school food or lunch?*
- *How would you like it to look and taste? And why?*
- *Does the texture and freshness of the food (e.g. how it looks), and taste (how it tastes) have impact on liking and disliking of the food?*
- *Do you reject any food based on their appearance (fx. Attractive or unattractive looks)?*

Themes: Media trends (Tik-Tok influencer; Media news; social media) influence on what is cool to bring to school

- *How do media news, advertisements or celebrity posts on social media influence your preferences for foods, e.g. on what is considered cool to eat at school?*
- *Which kind of news and trends have the biggest influence on your choices?*
- *Is it possible to have a critical stance toward how media portrays food?*

Themes: Food values and beliefs (Strong odour and the smell of food items)

- *Which types of food have a smell that is perceived to be unpleasant?*
- *Can the smell of food affect your willingness to eat it?*
- *How does cultural background influence our perception of food odours?*

Themes: Social norms and shared expectations

- *What kind of beliefs about food can you think of that exist in your peer group?*
- *Do you think that these common beliefs are helpful when it comes to avoiding food waste?*
- *Or do you think that they contribute to creating food waste?*
- *Do you agree with these common beliefs?*
- *What kind of shared norms and expectations exist in your group, and how might they contribute to food waste?*

Themes: Date marking of food products

- *How it may confuse people on two types of dates on food products: BEST BEFORE and USE BY.*
- *Do you know what to do with the food that just passed the BEST BEFORE date?*

- *Do you know what to do with the food that just passed the USE BY date?*

Themes: Portion size

- *How might the buffet setting and plate size influence food waste?*
- *What about yourself? Are you following this general rule at buffets?*
- *Can you think of any ways in which we can avoid taking too much from the buffet?*

3.2.6 **ATTACHMENT-2:** Themes and Inspirational questions for suggesting possible solutions (*what can we do to reduce or prevent food waste?)*

To come up with creative solutions for reducing food waste, the following themes and questions can serve inspiration.

Themes: SDG (Responsible consumption; Climate friendly food)

- *Could you think of actions that could help to reduce food waste?*
- *What is climate-friendly food and is it related to whether it is meat and plant-based?*
- *Think about the actions we could take to either avoid or reduce waste.*

Themes: Food chain (Production, processing, distribution, retailing to consumption)

- *Do you know in which part of the food value chain the most food waste happens?*
- *Have you noticed any food waste initiatives in your own favourite grocery shop?*
- *How our shopping behaviours contribute to food waste*

Themes: Peer group interaction (Viewpoints on the quality of food)

- *How do your friends and classmates talk about school lunch, e.g. what is nice to eat in lunch packs and what is not so nice?*
- *Why do you think that your peers think the way they think about food in lunch packs? And do you agree with them?*
- *How could student help each other to reduce food waste?*

Themes: Student-Parent interactions (Talking to parents about the food you like or dislike)

- *Can you think of 5 good tips you can use to create dialogue about food with parents in the case where you have a lunch box?*
- *Discuss some of the good tips to consider in preparing your lunch pack.*
- *Idea on communicating and convincing your parents to prepare the food you like!*

Themes: Re-use of surplus food

- *Can you think of ways to make a meal such as salad, sandwich, or fresh fruits sticks, from the surplus food available.*
- *Can you regrow some of the leftover vegetables? And if so, how would you do that?*
- *Can you think of some creative ideas to reuse surplus food?*

3.2.7 **ATTACHMENT-3:** Themes and Inspirational questions for understanding the consequences of food waste (what are the immediate or long-term effects?)

To explore the various consequences of food waste, for example environmental, social, health and economic consequences, following themes can serve as inspiration.

Themes: Nutritional and long-term health effects of wasting food

- *Discuss some of the good tips to consider in preparing your lunch pack.*
- *Give good examples to each other. Also, discuss the recommendations for eating more fruit and vegetables.*
- *Would you for instance like to try cucumber sticks, baked cauliflowers or other easy finger foods?*
- *Lunch provides important nutrients for our long-term personal health.*

Themes: Economy (Wasting food means wasting money)

- *How do you think it affects your economy if you waste a lot of food?*
- *How do you think it affects your economy if someone else waste food from the retail shop?*
- *How do you think it affects our economy if someone wastes food in the school canteen?*
- *Think in term of cost for production & resources is wasted when we waste food*

Themes: Social inequalities (World hunger)

- *Why do you think we should care about world hunger?*
- *Do you think there is a relation between food waste created in one place and hunger in other places?*
- *Food that we are ready to throw might be eaten by someone else*

Themes: Environmental impact

- *Discuss some of the signs and indicators of the environmental crisis we are facing?*
- *Discuss to what extent these signs of a crisis have a connection with the way our food system is working?*
- *Discuss some of the direct impacts of food waste?*
- *Consider food transportation and food miles*
- *Consider CO2 footprint of the food waste*

3.2.8 **ATTACHMENT-4:** Climate impacts data of selected food items[9]

SN	Name of the food Item	Category	Agriculture	Indirect Land use (iLUC)	Processing	Packaging	Transport	Retail	Total CO2_equivalent /Kg food
1	Artichoke	Veg. & veg. products	0,68	0,04	0,00	0,06	0,19	0,01	**0,98**
2	Asparagus, green	Veg. & veg. products	0,82	0,08	0,00	0,06	0,11	0,01	**1,08**
3	Aubergine	Veg. & veg. products	0,51	0,03	0,00	0,14	0,30	0,01	**0,99**
4	Basil, fresh	Veg. & veg. products	0,25	0,03	0,00	0,06	0,03	0,01	**0,38**
5	Beet, red	Veg. & veg. products	0,19	0,02	0,00	0,06	0,06	0,01	**0,33**

[9] The table of the dataset is prepared based on "The big CLIMATE DATABASE-Version 1.2" - https://denstoreklimadatabase.dk/en

Horizon Europe

SN	Name of the food Item	Category	Agriculture	Indirect Land use (iLUC)	Processing	Packaging	Transport	Retail	Total CO2_equivalent /Kg food
6	Beet, red, canned	Veg. & veg. products	0,30	0,02	0,20	0,22	0,11	0,01	**0,86**
7	Broccoli	Veg. & veg. products	0,42	0,04	0,00	0,06	0,11	0,01	**0,63**
8	Brussels sprouts	Veg. & veg. products	0,16	0,02	0,00	0,06	0,03	0,01	**0,29**
9	Cabbage, red	Veg. & veg. products	0,16	0,02	0,00	0,06	0,03	0,01	**0,29**
10	Carrot	Veg. & veg. products	0,15	0,02	0,00	0,06	0,04	0,01	**0,27**
11	Cauliflower	Veg. & veg. products	0,42	0,04	0,00	0,06	0,11	0,01	**0,63**
12	Celery	Veg. & veg. products	0,25	0,03	0,00	0,06	0,03	0,01	**0,38**
13	Cucumber	Veg. & veg. products	0,15	0,01	0,00	0,14	0,08	0,01	**0,40**
14	Onion	Veg. & veg. products	0,15	0,02	0,00	0,06	0,03	0,01	**0,27**
15	Parsley	Veg. & veg. products	0,25	0,03	0,00	0,14	0,03	0,01	**0,45**
16	Potato	Veg. & veg. products	0,26	0,02	0,00	0,06	0,06	0,01	**0,41**
17	Potato, canned	Veg. & veg. products	0,41	0,03	0,20	0,22	0,12	0,01	**0,99**
18	Spinach	Veg. & veg. products	0,31	0,03	0,00	0,06	0,08	0,01	**0,48**
19	Tomato	Veg. & veg. products	0,21	0,01	0,00	0,14	0,11	0,01	**0,48**
20	Tomato paste, concentrated	Veg. & veg. products	1,00	0,06	0,51	0,78	0,31	0,01	**2,67**
21	Apple	Fruits & fruit products	0,34	0,02	0,00	0,14	0,10	0,01	**0,61**
22	Avocado	Fruits & fruit products	0,77	0,05	0,00	0,14	0,25	0,01	**1,22**
23	Banana	Fruits & fruit products	0,43	0,03	0,00	0,14	0,25	0,01	**0,85**
24	Blueberries	Fruits & fruit products	0,82	0,07	0,00	0,14	0,18	0,01	**1,22**
25	Grape	Fruits & fruit products	0,54	0,04	0,00	0,14	0,16	0,01	**0,88**
26	Kiwi fruit	Fruits & fruit products	0,43	0,03	0,00	0,14	0,14	0,01	**0,75**
27	Lemon	Fruits & fruit products	0,33	0,03	0,00	0,14	0,17	0,01	**0,67**
28	Mango	Fruits & fruit products	0,57	0,05	0,00	0,14	0,24	0,01	**1,01**
29	Orange	Fruits & fruit products	0,31	0,03	0,00	0,06	0,16	0,01	**0,56**
30	Pineapple	Fruits & fruit products	0,30	0,02	0,00	0,00	0,24	0,01	**0,56**
31	Pineapple, canned	Fruits & fruit products	0,28	0,03	0,22	0,22	0,37	0,01	**1,13**

SN	Name of the food Item	Category	Agriculture	Indirect Land use (iLUC)	Processing	Packaging	Transport	Retail	Total CO2_equivalent /Kg food
32	Strawberry	Fruits & fruit products	0,41	0,04	0,00	0,14	0,06	0,01	**0,65**
33	Watermelon	Fruits & fruit products	0,22	0,01	0,00	0,00	0,16	0,01	**0,40**
34	Biscuit, sweet	Bread & bakery	0,84	0,07	1,16	0,67	0,18	0,01	**2,93**
35	Burger bun	Bread & bakery	0,87	0,06	0,11	0,04	0,07	0,01	**1,16**
36	Rye bread, dark, whole grains, industrially produced	Bread & bakery	0,70	0,06	0,13	0,04	0,07	0,01	**1,02**
37	Tortilla bread, wheat	Bread & bakery	0,87	0,06	0,11	0,04	0,07	0,01	**1,16**
38	Wheat bread, for toasting, industrially produced	Bread & bakery	0,87	0,06	0,11	0,04	0,07	0,01	**1,16**
39	Beef, meat, average	Meat & poultry	60,82	15,81	-2,97	0,14	1,05	0,00	**74,84**
40	Beef, mince, 5-10% fat	Meat & poultry	42,05	10,99	-3,23	0,14	0,67	0,00	**50,61**
41	Beef, sausage, salami	Meat & poultry	38,94	10,05	-0,54	0,02	0,68	0,01	**49,16**
42	Chicken, meat, average	Meat & poultry	2,71	0,18	-0,01	0,14	0,25	0,00	**3,27**
43	Chicken, minced	Meat & poultry	5,01	0,36	-0,09	0,14	0,28	0,00	**5,71**
44	Chicken, whole	Meat & poultry	2,71	0,18	-0,01	0,14	0,25	0,00	**3,27**
45	Lamb, meat, average values	Meat & poultry	36,94	4,22	-5,34	0,14	0,48	0,00	**36,43**
46	Lamb, minced	Meat & poultry	34,99	3,99	-4,82	0,14	0,43	0,00	**34,73**
47	Pork, meat, average	Meat & poultry	4,35	0,25	-0,23	0,14	0,19	0,00	**4,69**
48	Pork, mince, 5-10% fat	Meat & poultry	3,87	0,25	-0,71	0,14	0,13	0,00	**3,67**
49	Falafel mince	Plant products	0,96	0,17	0,18	0,64	0,11	0,00	**2,06**
50	Olive oil	Plant products	4,33	0,64	-0,03	0,56	0,38	0,01	**5,89**
51	Sunflower oil	Plant products	0,00	0,00	1,92	0,56	0,30	0,01	**2,79**
52	Vegan burger, soy based	Plant products	0,08	0,04	0,21	0,26	0,07	0,02	**0,69**
53	Chestnut	Nuts & seeds	1,73	0,11	0,00	0,14	0,33	0,01	**2,31**
54	Peanuts, oil roasted and salted	Nuts & seeds	1,91	0,22	0,72	0,26	0,35	0,01	**3,47**
55	Blue cheese	Milk, dairy & eggs	2,67	-1,33	-0,35	0,35	0,26	0,00	**1,60**
56	Cheese, hard, Parmesan, 32 % fidm.	Milk, dairy & eggs	4,46	-2,34	2,52	0,35	0,42	0,00	**5,41**
57	Eggs, free-range (indoor)	Milk, dairy & eggs	0,57	0,07	0,00	0,24	0,09	0,01	**0,97**
58	Milk, whole, 3.5 % fat	Milk, dairy & eggs	0,48	-0,24	0,12	0,08	0,07	0,00	**0,50**
59	Yogurt plain, whole milk	Milk, dairy & eggs	0,47	-0,24	0,17	0,26	0,07	0,00	**0,73**

SN	Name of the food Item	Category	Agriculture	Indirect Land use (iLUC)	Processing	Packaging	Transport	Retail	Total CO2_equivalent /Kg food
60	Breakfast cereal, muesli, average values	Cereal products	1,35	0,15	0,15	0,58	0,07	0,01	**2,31**
61	Corn flakes, average values	Cereal products	1,22	0,14	0,31	0,58	0,13	0,01	**2,39**
62	Pasta	Cereal products	1,18	0,09	0,18	0,23	0,36	0,01	**2,05**
63	Rice flour	Cereal products	4,37	0,17	0,00	0,20	0,38	0,01	**5,12**
64	Rye flour, dark, whole meal	Cereal products	0,78	0,09	0,03	0,20	0,07	0,01	**1,17**
65	Wheat, flour, wholemeal	Cereal products	0,86	0,07	0,03	0,20	0,07	0,01	**1,24**

As shown in , below, overview of the climate impact (CO2 emissions) associated with different food categories, highlighting the five main stages of CO2 contribution across food supply chain. The figure shows that meat and poultry category have highest Climate CO2 impact and mainly come from agriculture production. The climate impact in the Fruits and Vegetable category mainly contributed from transportation.

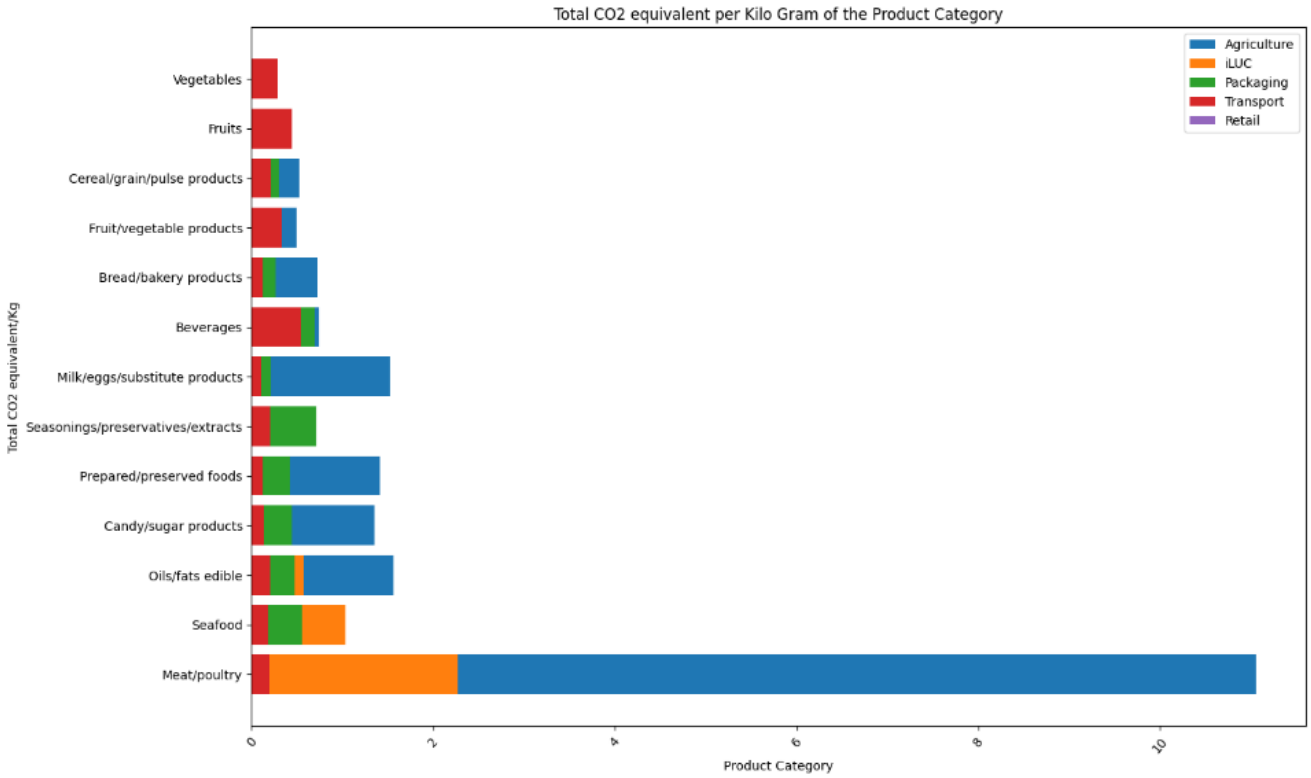


Figure 8 Overview of CO2 impact of the food product category. Source CONCITO food climate dataset

3.2.9 **ATTACHMENT-5:** Working table to calculate Climate impact in your own case.

By using a climate impact table (ATTACHMENT-4) any action and food behaviour, any change or intervention can be expressed in terms of carbon equivalents (kg. CO_2/ pr.kg). In other words, anything you do with food - or choose not to do - can be expressed in terms of impact on the climate (CO_2 emissions).

Let's say for instance, you found that about *half a cucumber* which is approximately *150 gram* is wasted in the school canteen and that you decide that this should stop. That action - or intervention - can then be calculated in terms of – in this case a positive - impact on the climate.

So, in order to do the calculation for any other food, you will need to know **what types** of foods are wasted and in **what amounts**. Once you have this list of **types and amounts** you can start converting those to climate equivalence in table below.

Food item in focus *- write the name of each food item to calculate CO2 impact (a)*	**Amount** *- edible amount of food items "convert to kg" (b)*	**CO2 Impact** (in kg CO_2/pr kg food) *- CO_2 impact of food item in focus (See Attachment-4) (c)*	**Avoided CO2 impact** *Grams of food X kg CO_2/pr.kg (d=b x c)*	**Where does most of CO2 come from?** *- what part of the supply chain have higher CO2 impact? (See Attachment-4) (e)*
For example, Half cucumber	*For example,* 150 grams = 0,15 kg	*For example,* 0.5	*For example,* 0,075 *kg CO_2/pr.kg* (0,15 kg * 0,5)	*For example,* Transportation
Total *(add the amounts from Avoided CO2 impact)*				

What can we do with CO2 impact avoided? Put them in the figures below.

CO2 impact equivalent to Cop of tea or

Average equivalent:

- 1kg CO2 = 16 cups of tea

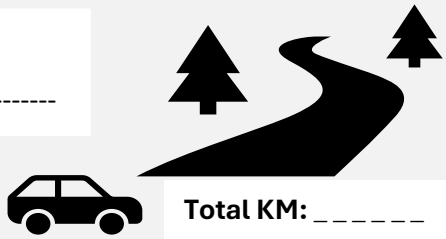
- 1kg CO2 = 2 cups of Coffee

No. of tea cups:

No. of coffee cups:

CO2 impact equivalent to Driving car

From: Name of the City



To: Name of the City

Total KM: _ _ _ _ _ _

Average equivalent: *1kg CO2 = 3.7 Km drive*

4 CONCLUSION

The development and implementation of the Science Educational Package (SEP) within the CHORIZO project have demonstrated a compelling and innovative approach to tackling food waste through education. By integrating scientific knowledge with ethical and behavioural learning, the SEP successfully engaged students in understanding the environmental, social, and personal implications of food waste. The use of reflections, hands-on experiments, and gamification created an immersive and enjoyable learning experience that fostered empathy, critical thinking, and a sense of shared responsibility.

Validation of the SEP across two phases confirmed its educational value and relevance. The first phase, involving expert feedback in Bologna General Assembly, helped refine the design and content of *"An educational board game against food waste"* and *"Hack Your School Food"*. The second phase, focused on classroom testing in Denmark, Germany, Austria, and Spain, provided practical insights into the SEP's effectiveness and usability. Students found the board game engaging and informative, while teachers highlighted its potential for raising awareness and facilitating discussion—though they also noted challenges related to complexity, accessibility, and classroom logistics.

Qualitative findings from interviews with pupils, parents, and educators revealed that while awareness of food waste is growing, behavioural change is often hindered by sensory preferences, peer influence, and limited communication between children and parents. The absence of structured feedback loops and supportive school environments emerged as key barriers to sustainable food behaviours.

Gamification proved to be a particularly effective strategy for bridging the gap between knowledge and action. SEP's co-creation process and user-centred design led to the development of adaptable, inquiry-based tools that are both scientifically robust and pedagogically sound.

5 RECOMMENDATION

To maximize the impact and sustainability of the Science Educational Package (SEP) developed under the CHORIZO project, the following strategic recommendations are proposed:

- **Scale and Contextualize Implementation:** Expand SEP deployment to more schools across Denmark and other EU countries. Adapt content to reflect local food cultures, school lunch systems, and age-specific learning needs to ensure relevance and inclusivity.

- **Strengthen Teacher Support and Capacity:** Provide training materials and facilitation guides to help educators implement SEP effectively. Encourage teacher-led adaptation of content to suit classroom dynamics and student needs.

- **Foster Family Engagement:** Extend learning beyond the classroom through take-home activities, and workshops. Strengthen parent-pupil communication via "An educational board game" to encourage dialogue about food habits and waste.

- **Leverage Digital Platforms and Feedback Mechanisms:** Develop digital versions of SEP tools to increase accessibility and engagement. Implement feedback systems for students, teachers, and parents to support continuous improvement and responsiveness to evolving needs.

- **Monitor and Evaluate Long-Term Impact:** Establish mechanisms for tracking behavioural changes over time to assess effectiveness and inform policy advocacy. Use data from the CHORIZO project to refine content and support evidence-based decision-making.

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7 APPENDICES

7.1 Extraction of the interview data for Boardgame

7.1.1 ATTITUDES AND AWARENESS OF FOOD WASTE

Social norms / Perspectives	Attitude socially and psychologically constructed ways of thinking about food and food waste	Awareness how people are aware of the consequences of their choices (of throwing away food)	Motivation willingness to engage in avoiding food waste
Climate change Land and resources used to produce food have an impact on the climate	*"....So this discussion about food is definitely also an educational issue. Because for example, I know that many of the big girls especially like to wear second-hand clothes. They're so climate conscious, right, and then we look at the food and that's completely the other way around? So that,.....I would say, in some way as there is one missing in school..."*	*"....Um....The consequence can be like children who don't get anything to eat, like .....Yes but It's all that CO2, all sorts of things that make the earth warm....."*	".....children must have a basic food knowledge. That is, there must be a type of champion like the contact teacher or another teacher who tells that you can actually make a really good spaghetti meat sauce from fermented tomatoes and bolognese or with minced chicken instead of beef. The teachers share their thoughts on making food education and learning more interesting by putting practical example of the sustainability and connect theory with kids' daily life activities.
Production chain How food travel between locations and the resources used in this	*".....I often throw bananas out because I hate bananas. They just get so gross! Because they get gross and brown and mushy...."* *What could be a good alternative to throw out a ripe banana?* *Tale med forældre...* *Putte dem i en boks...* *Andet...*	*".....we think it's not very good because food has to be transported all the way to the stores [shops]. It requires some CO2, so it's not very good for the climate...."* *".....I think it's important to teach children about how the food system works. For example, that of the vegetables that enter the supply chain every day, 20% are thrown away. ... "*	

Social norms / Perspectives	Attitude socially and psychologically constructed ways of thinking about food and food waste	Awareness how people are aware of the consequences of their choices (of throwing away food)	Motivation willingness to engage in avoiding food waste
Economy 'Throwing out money'	*…it usually comes home completely untouched, so it's actually pretty stupid that I make it at all…"*	*"it also costs money, if you just throw it out, then it's just like throwing money out….."* *……I also think that food waste is a waste of money, but you don't have to eat it all….."* *"….someone comes over to me [with surplus food from her lunch pack], I don't really care. It's not my money, it's going out, but if it's my own lunch box, then it's my parents who spent money, and then I don't want to waste so much….."*	Having a fridge might help to reduce food waste from lunch pack by making it possible to save non eaten items for the next day and also keep the food fresh and more appetizing. *"……..When children buy food outside school, there is actually something that suggest that they have a different behaviour about it, simply because they paid for it. And that's why they eat it to a greater extent. But also because it is their own choice. They have chosen themselves so, they eat too. Because then it's usually because they're actually hungry too, right?……."* *"……if I've brought salmon with me, it comes home to my dad and I sometimes give some of it to my cat…."* *"…..my dad is sort of a food bin in our family, so if there's something you can't eat, he just gets it [to eat]. But there's just the thing about it that my father, he works a lot. So when he's not home, there's no "food-bin" and then it goes to the trash……"*
Health Food as nutrition	"picky, selective and conservative" *"……they feel like sugar is alright, so if they have a slice of pizza or cake, that's always commendable,…"*	*….Yes, I always throw out pasta? We think it's vegetables and leftovers of meat sauce and soup [that been mostly thrown out from school food]……."* *"…..then there is something about*	

Social norms / Perspectives	Attitude socially and psychologically constructed ways of thinking about food and food waste	Awareness how people are aware of the consequences of their choices (of throwing away food)	Motivation willingness to engage in avoiding food waste
	"association between healthy food and food waste"	*vegetables? Yes, because if you bring a delicious salad, you'll want to eat it. But if you just get vegetable sticks with you, then it is also often that it is thrown out. I guess they think it's boring……"*	
National and global inequalities Lack of food vs. food abundance	*"……..when you want to try something new, and then you don't like it, you throw it out because you don't like it, and you think, I'd like to try something new….."*	*"there is not enough food"*	*….We also relate to others besides us and our little world at home. We are talking about the other countries, some of the poorest countries, where children also live and still there are children dying of hunger. We don't really relate to that, but at least it's discussed. That's how we kind of also get the opportunity to develop empathy for some kids and think, … they're often so ungrateful….*
Social behaviour and dynamics around food waste	A sensitive social culture. *"……they would really like to throw out "smelly food". In other words, food that smells strong or has odors [odour]. If they have brought something from home that they normally want to eat, but that they think it smells [at the school], Then they want to throw it away, it seems like it is very important for them to know if it is socially acceptable to bring a mackerel sandwich or not [the social context is very important, and smelly food will be considered "unacceptable" and thrown out]……"*	*….then you see others throw it out, so you can also do it yourself….."* *……if you now see someone else who also doesn't like the meat sauce and then throw it out. And maybe you also think it looks a little mushy and gross. Then you are more likely to also throw it out yourself……"* *"….they would really like to throw out "smelly food". In other words, food that smells strong or has odors [odour]……"*	In the older classes norms about the uncoolness of lunch packages doesn't necessarily lead to food waste as the pupils simply don't bring a packed lunch. Pupils mention the lack of doggy bags as a barrier for taking home leftover canteen food. A bad eating environment is also mentioned as creating a less optimal eating situation leading to food waste. *…..we seem to have a lack of knowledge with our student group and half of the parent group about sustainability in general and (food) waste. …."*

Social norms / Perspectives	Attitude socially and psychologically constructed ways of thinking about food and food waste	Awareness how people are aware of the consequences of their choices (of throwing away food)	Motivation willingness to engage in avoiding food waste
			"….we do, in addition to that, I also talk a lot about recycling. So if there is surplus food, how can I reuse the food, or think to solve this problem….." *"….you've just taken an extra meatball which may not be eaten. Could I make smaller meatballs next time? So fewer meatballs next time because you think and reflect. Well, we have these conversations open in the family……"* It appears that parents who love to cook also try to be creative with preparing lunch-pack and that tends to result in reduced waste. Also, involving kids in meal preparation makes consumption increase and reduces food waste.

7.1.2 ATTITUDES AND AWARENESS OF FOOD

Social norms / Perspectives	Attitude	Awareness	Motivations
Healthy/unhealthy food	*"……they feel like sugar is alright, so if they have a slice of pizza or cake, that's always commendable…"* "healthy" food is perceived as gross or boring and children are more likely to eat fast food or candy because it tastes "better". A factor also mentioned is that they sometimes get tired of the "same" foods that they eat every day, so they want ex.	most pupils from upper school go out to buy their lunch from the supermarket, corner-stores, mini market and that this in most cases results in them buying mostly unhealthy items such as ultra processed food. *Then there may be groups in the same class who then may not have*	*"…… I try to bring something where I kind of know that there is a pretty good chance that he will eat or drink, but... It's typical that if he gets 5 things and there are 2 things that are kind of semi-unhealthy. Let's say it's a muesli bar with chocolates or a smoothie or something*

Social norms / Perspectives	Attitude	Awareness	Motivations
	Pizza because they never eat that. So, rye bread is thrown out because it's boring and they get it every day.	*the same hinterland, where it ends up in either pizza slices or buns from the bakery. But to make a general statement about it with the healthiness or unhealthiness, I think that's really, really difficult....."* *"I think one of the biggest challenges we face as a society today is that it became so easy and so cheap to buy the foods ready-made. And I am not only talking junk food. It is also semi-produced, semi-prepared or ready-made goods in our supermarket, right? They are cheap and highly processed. But we have no clue as to how they are made. So the craft and the basic knowledge about diet and nutrition is under pressure. Children today don't learn to peel potatoes and fry meatballs and make a brown sauce with balsamic vinegar....."*	*[referring semi-unhealthy items in the lunch pack], then that's what he eats. But then I am also sure that he will get at least something during a day....."* ".....children must have a basic food knowledge. That is, there must be a type of champion like the contact teacher or another teacher who tells that you can actually make a really good spaghetti meat sauce from fermented tomatoes and bolognese or with minced chicken instead of beef. So the thing about giving them some food knowledge skills, but also make them to make some calories and some energy calculations on the foods we have with us. So competencies I definitely think is what we are looking for... *"..... I'm trying to find a balance, so it's chicken, beef and pork, but also vegetables. It tends to be quite simple – something like carrots and cucumber sticks or something else simple that we know they will eat. In other words, we try to keep a style where on average it's a reasonably healthy meal. So it's not hysterical, but also not*

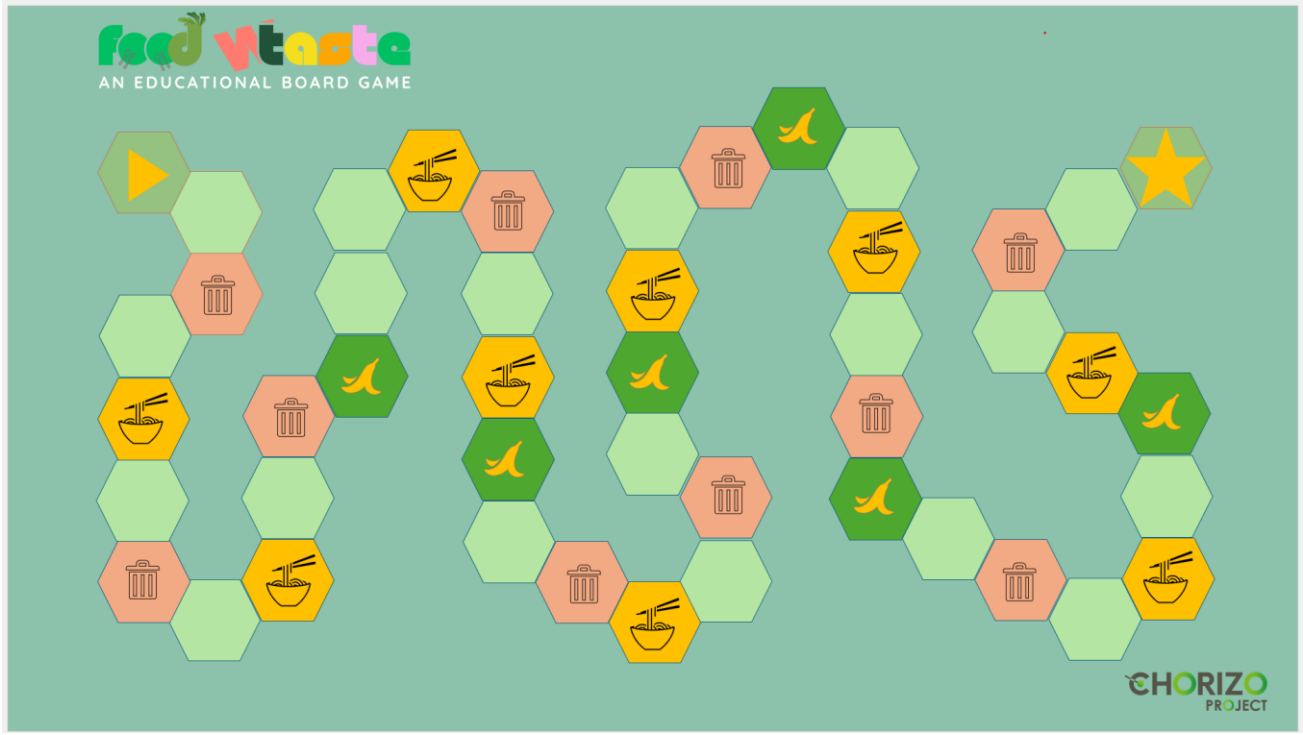
Social norms / Perspectives	Attitude	Awareness	Motivations
			that kind of junk all the time……"
Materiality of food and eating	"Texture, taste and mixed together" *"……..Children's dishes they are maybe kind of simple, not so complicated. They are very simple compared to the adults' dishes, where it has been decorated [the adult dishes can be garnished with ex. Parsley]……."* Food might be seen as "wrong" or of not good quality according to existing social norms or individual preferences or if the food is cold or doesn't have the right texture that it is "supposed" to like overcooked pasta, soft tomatoes or a mealy apple. "picky, selective and conservative" Food waste increases when food does not comply with 'perfection': a small spot (like a brown spot) on apple, banana being little too soft, a piece of bread that's a little too soft or moist, a bun that's broken a little, food that smells strong.	*"……..if you get a portion of lasagna at home. Then it tastes normal, but if you get it elsewhere it can taste different, then you don't think it's very good, it doesn't taste like what you usually get……."*	*"……Can we create a framework for putting our packed lunches in a fridge, so we have the opportunity to extend the shelf life of this. Because that's usually what causes it to be thrown out. Because the lunch box that has been in the school bag for 8 hours, you will not want to eat it later or the next day again. So it's a lot in terms of marketing, and the whole thing, how we guide and help students be able to choose the alternatives that are healthy and sensible again tomorrow……."*
Sociality of food	Social media and the coolness of certain types of food "attention and performance culture" *it's cool to bring pizza. But it's not cool to bring carrots….."* *"…..what has prestige to it is, Pølsehorn and pizza. These are the kinds of things that*	A major factor mentioned by both pupils and teachers is that the current lunch environment is not supportive to good eating behaviours as pupils in many cases eat unsupervised in the class.	Making lunch breaks more fun and organized keeping the principles of commensality in mind could be beneficial. This could be achieved through the provision practical guidelines, tips, and tricks and as well as with guidance on how teacher intervention in

Social norms / Perspectives	Attitude	Awareness	Motivations
	have prestige among those at the intermediate level [middle school 4th-6th grade]...."" advertising and marketing have huge influence on what they will choose if they got chance. *".....it's my feeling it's just a kind of cultural norm spreading in the class that it's uncool to have food with you in the form of a lunch pack..."* *".....there can be classes where it is very little prestigious to eat a packed lunch at all and that it is conditioned by age....."* It seems as if there is a hierarchy for different foods in a social context set by the "strongest" pupils. This means that the social norms created within the classroom regarding food can in some ways set the social status of each pupil. *".....he doesn't particularly like eating with others....."* *"....I think right now our biggest problem in the world is that we've kind of shamed everything called sugar and carbs. And exactly that makes it interesting and cool [shaming certain foods makes it appear more interesting] So I think you kind of have to, kind of go back a little bit from the shaming approach...."*	It is also widely expressed that pupils try to minimize time for eating to go playing in the school yard. This might result in rushing through lunch (particularly for boys). Yet, some kids complain about not having enough time for lunch at school.	lunch breaks could be organized in the most feasible way. This could create a setting with many beneficial aspects, both socially, pedagogically and educationally. *The lunch environment is bad. So we try to create such an environment where all children can sit down, eat their food, relax around their meal and have something in common and social while eating. But the eating environment itself is not there yet, because there is a lot of attention to what food do others bring?....."* School creates a good environment for an impact regarding food and food waste. The school also creates a good setting for framework on "the proper lunch". *"....I think the multicultural aspect comes in and in is very important. We need to be aware of and take advantage of different ethnicities into our thinking around food. We have a potential to be able to present the children many different kinds of foods, for many different taste experiences, and I think we should cultivate that ats school....."*

Social norms / Perspectives	Attitude	Awareness	Motivations
Interactions between parents and children	"parents seem to have developed a routine that might be hard to change and as a consequence they made similar type of lunch box repeatably." younger pupils are more prone to follow advice from parents (mother) the older students choose unhealthy options to rebel against parental dietary expectations. "sometimes the pupils will throw out food to avoid getting yelled at when they come home with a full lunch box" Children mention eating situations at home where they must hide the food they don't want to eat and in general more conflicts about not eating. ".....They know it, but they're still trying to give me carrots....." ".....Maybe at home, when you throw out food and your mom and dad get angry. Then it can be a little bit so that at school when your mom and dad aren't there, you can do it....." Food waste also happens at home since it is often the parents who put food on the plate, and then there is too much food, or they get something they don't like for example when trying new things.	*"You can find yourself thinking that it's kind of a pointless exercise that it does not make much of a sense to make packed lunches. Since I know he's not eating it. But on the other hand, this is also so that if he gets hungry, there must be something for him. It's like a bit of a "what if" exercise for me....."* *..... I don't eat with my family that much, because then I'm either at football or something and then I eat something, or I eat out in the car, or I eat with my friends at the club [after school activity]....."* Some of the pupils express their stress when parent ask what they want in the lunch-pack and are unable to provide concreate answer although they are open to try something new. This could be at the supermarket where the pupils are overwhelmed with choices. Teachers believe that we need to provide proper reasons for the pupils to talk about food waste, as they need realistic arguments. Some parents share their strategy of creating empathy and give a bigger picture of the world hunger to make them feel grateful with what they have. Some school strategies to help	Some parents have established dialogue based transparent ways of communication where it doesn't become a crime to bring your lunch back home as long as there are routines for handling that in a meaningful way. In some cases parents are not having a clear idea of kids preference and how to motivate towards more healthier eating and reduced food waste. Parents also experience that when they try to control their kids with approach of-shouldn´t or-mustn´t- it tends to yield completely oppositive results. ".....I agree with the nudging! I know it's a time spoiler but I think how we can turn it into something social. When I do the lunch box of course of course I can save time on doing it alone. But then I loose the learning opportunity, I take away responsibility and I take away the social learning. So the thing about inviting my son over and you say lets do the rye bread thing together actually can make a difference....." *"..... I'm trying to find a balance, so it's chicken, beef and pork, but also vegetables. It tends to*

Social norms / Perspectives	Attitude	Awareness	Motivations
		parents and pupils by asking at least 10 most relevant question that they could ask each other regarding lunch-pack and dinner. Another strategy is that if there are lunch-packs thrown out in the school garbage can, the school can take pictures and send them to all the parents (through school-parent communication channel) so parents can recognize the lunch pack and talk to their children about why they threw it out.	*be quite simple – something like carrots and cucumber sticks or something else simple that we know they will eat. In other words, we try to keep a style where on average it's a reasonably healthy meal. So it's not hysterical, but also not that kind of junk all the time……"* *"……So in terms of his packed lunches, we kind of try to run a style where we try to tempt his eyes a little bit. so it doesn't get too boring- So he gets mixed food, then he gets some vegetables, also fruit in, also that drinking yogurt, or it can be a rice biscuit or so kind of tries to also vary this kind of little or a package of raisins when something then makes it a little more exciting. So it doesn't just becomes these flat sandwiches and make it kind of appetizing. But such a good mix of he gets both some bread and some fruit and some vegetables……"*

7.2 Template of Boardgame and it's rule and regulations



food waste
AN EDUCATIONAL BOARD GAME

RULES OF THE GAME

All players place their tokens on START.

Players roll the dice and move the number shown on the dice. If a player lands on a space with an icon, a card is drawn from one of the two piles. There are three types of cards:

= **Question cards**: When a player lands on a trash can, one of the other players draws a card from the deck and reads the question. If the answer is correct, the player gets to hit again. If the answer is incorrect, the turn passes to the next player.

= **Reflection cards**: The player draws the card and reads it out loud. The players reflect and share the topic related to drawn card. When you have finished talking about the topic, the turn passes to the next player.

= **Action cards**: These cards refer to actions or attitudes that have to do with food waste. The player draws a card and follow the instruction.

The player who first reaches the end ★ has won.

BACKGROUND INFORMATION

CHORIZO PROJECT

MANNUE FOR THE GAME

To play the game you need:

- 1-2 dices for each board
- A token for each player (various colors)
- Reflection, Question & Action cards
- The Board

To print:

- The Rules & Instructions of the game in A4-size paper
- The Board in A3-size paper in color
- A set of Cards (Question, Reflection, & Action) in A4-size paper making Icons on one side and text in the other side

Procedure to play:

- Can be played between 2 to 4 players

This board game is developed to increase knowledge about food waste as well as to encourage behavioral change through dialogue and reflection among players. It is designed as an activity that can be carried out in the classroom among pupils or at home with the family. With objectives:

- *learning about food waste and its impact in our daily life.*
- *Reflections about social norms around food waste and their impact*
- *Fostering dialogue to uncover the reasons behind wasting food among pupils and between parents and children*

The game is educative in its way of informing about food waste and drawing attention to how social norms and individual behavior take part in the global problem of wasting food. It is based on research from the Chorizo project about young people's food behavior and attitudes as well as social norms around food and food waste. Food habits are contextual and influenced by culture and traditions, geographical regions, social media, education and food environments. Therefore, teachers alike are encouraged to form new questions, reflections and actions that are more relevant to their context.

A few words on concepts used in the game

Food loss and Food waste: Any food that can be eaten but is wasted. In general, food loss happens during production and food waste happens in retail and the consumers.

School lunch: Different countries have different school meal programs and traditions. Some countries, it is common for schoolchildren to bring food from home, so-called lunch packs. In some other EU countries, pupils eat in the school canteen.

Social norms: Social norms are social expectations about how we should behave. Social norms influence our thinking about ourselves and others and guide what we think is acceptable, good or bad. Social norms differ through time and from culture to culture. For example, food that is considered good to eat at home might not be cool to eat in school due to social influences among pupils. Also, 'funny' or 'ugly' looking fruits and vegetables can be rejected because of social influence. Even within the same country there can be different social norms for what is good or bad food.

Social media: social media covers various platforms, websites, and apps, where people interact with each other as well as with different content online. Interactions can be discussions, commenting or liking each other's content. Today, social media is a means of rapid circulation of information and trends and central in creating and spreading social norms.

Statements: The game's reflection cards include quotes/statements from interviews conducted with pupils in Danish schools. They illustrate examples of dilemmas and challenges that can be associated with food waste. Players are asked to reflect on them from their own perspective and experiences.

7.3 Template of playing cards "Reflection, Action & Question"

Reflection Card

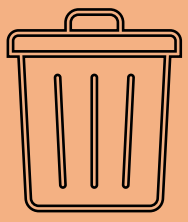
How does throwing away food contribute to the waste of resources used in its production, such as water, energy, labor, and transportation?

Hints: Use of water and energy for the processing, materials for packaging, use of transportation to deliver foods.

Action Card

You prank your family by turning off the refrigerator. You will have to throw out all the food.

Move back 3 spaces.



Question Card

Which food category has the biggest CO2 impact on the climate from its production?

A: Fruits and Vegetables

B: Pulses

C: Meat


CHORIZO
PROJECT


Horizon
Europe