MODULE II

Lesson Plan 3

Summary

Title	
Composting station	
Duration	135 minutes
The age range of students	10-14

Summary of the theme

This topic guides students in the creation of a classroom composting micro-station, integrating concepts of sustainability, recycling, and soil science. It seeks to foster practical understanding and applicability of knowledge through the creation of a working prototype. Students will learn concepts linked to the life cycle of organic waste and its transformation into compost, promoting an interdisciplinary approach in cultural, environmental, and economic contexts.

Learning outcomes

Aim/Learning Objectives.

- Understand the concept and importance of composting and sustainability.
- Learn about the biological and chemical processes involved in composting.
- Develop practical skills in the construction and maintenance of a composting station.
- Encourage critical thinking and problem-solving through prototyping.

Cross-cutting objectives

- Promote environmental awareness and ecological responsibility.
- Encourage collaboration and teamwork.
- Develop STEAM skills through practical and experimental activities.

Connection with Sustainable Development Goals

This theme is aligned with SDG 12 "Ensure sustainable consumption and production patterns"- Target 12.5 By 2030, significantly reduce waste generation through prevention, reduction, recycling, and reuse.

Implementation

Facilitation

- Prepare all necessary materials before the class (containers, organic waste, gardening tools, etc.).
- Ensure adequate space where students can work comfortably and get dirty if necessary.
- Use recycled and recyclable materials wherever possible.
- Promote group discussion and collaboration during activities.

Resources / Materials needed

- 2-litre soft drink bottles (2 for each station)
- Scissors
- Drawing pin or awl
- Adhesive tape
- Marker pen
- Rule
- Thermometer
- Kitchen scale
- Wooden stick
- Organic waste: vegetable waste, tea bags, coffee grounds, fruit waste, etc. (avoid meat, fish, and dairy waste).
- Soil: dry leaves, woody debris, eggshells, vegetable or fruit peels, etc.
- Paper for recycling

Ideas to continue

- Implement a monitoring program for the compost produced.
- Conduct visits to local community gardens or composting centres.
- Initiate projects related to the reuse of compost in school or community gardens.
- Composting audit in the classroom/school. In the following link, you have all the information to carry out the activity: https://www.worldwildlife.org/teaching-resources/toolkits/be-a-food-waste-warrior

Source / Classroom materials and preparation

- A guide to composting in schools. Link: https://greenmountainfarmtoschool.org/wp-content/uploads/2016/01/Guide-to-Staring-a-School-Compost-Program.pdf

- Web Life Lab's School Composting Resource Page. Offers a variety of resources, including step-by-step guides on how to start a school composting system, how to collect food waste, and how to maintain compost. Link: https://www.lifelab.org/school-garden-resources-all/2014/02/composting-curriculum
- Eco-Cycle Solutions. They offer K-12 composting programs, providing guides, videos, and educational tools to implement and manage an effective school composting program. Links:
    - https://ecocycle.org/content/uploads/2022/06/25_Schoolwide-Compost-Collection-Chapter-25.pdf
    - https://ecocycle.org/content/uploads/2022/06/24_Backyard-Composting-at-School-Chapter-24.pdf
- Cornell Composting: Composting in Schools. Page with different resources for carrying out composting projects in schools. Link: https://compost.css.cornell.edu/schools.html

Topic outline

Time	Step-by-step instructions
45 min	Introduction to composting and its importance Start the class with an interactive discussion about composting. Explain what composting is, how it works, and why it is important for the environment. Use visual examples such as infographics or short videos to illustrate the process. Suggested links to use: https://cococoirglobal.com/what-is-compost/; https://www.youtube.com/watch?v=iV9s-KFZ4Ms; https://sustainability.yale.edu/explainers/yale-experts-explain-compost You can ask students questions to test their prior knowledge and encourage participation. Example: Start a conversation about food waste with questions such as: - Have you ever opened the food sent from home or picked up your lunch tray and food in the canteen and didn't like it or weren't hungry? - What were or are you doing with that food? When students share their answers, you can ask them clarifying and open-ended questions such as the following: - What do you think happens to food once you throw it away? To introduce students to food composting, the following activity is proposed under the title "Food is not rubbish". It is a waste-sorting game (source: https://www.worldwildlife.org/teaching-resources/toolkits/be-a-food-waste-warrior). Instructions for the activity: 1. Print the posters (Save it, Share it, Compost it) and attach them to three different buckets or boxes. Posters are available in the Annexes.

2. Divide the class into groups of 2-4 students. Make enough copies of the food pages so that each group has a copy of each (see Annexes Figures 2.3.2, 2.3.3, 2.3.4, 2.3.5). Give a set of food pages to each group and ask them to cut them out.
3. Ask them to classify different foods into three categories: Keep it, Share it, and Compost it.
   Remember the following:

Compostables	Non-compostable
Fruit and vegetables Nutshells Tea bags Coffee grounds	Dairy products Bones Meat or fish Bakery products

4. Finally, when they have finished sorting, there is a discussion about why they have put the different images in the cubes. They should justify each classification and discuss if they disagree. The aim is to get them to think about food waste.

To conclude the introduction to the topic, it is suggested that students play an online waste-sorting game with different levels, either individually, in pairs, or in small groups. Link: https://rhodeislandresource.recycle.game/

45 min

Lunch in the classroom

This activity must be scheduled and announced days in advance. Each student should bring lunch from home. Allergies should be taken into account when distributing the students in the classroom. Dynamics of the activity:

1. Before starting to eat, give each student a disposable container.
2. After eating, ask students to put the food and drink in the container. Do not include wrappers, sandwich bags, etc.
3. Each pupil will weigh his/her container on a scale after finishing the meal.
4. Record individual and overall classroom quantities.
5. Reflect on how waste could be reduced. Analyse how much food has been put in the containers after the end of lunch and not tasted.

At the end of the discussion, show the video on growing carrots: https://www.youtube.com/watch?v=vLuTeAf9krc. It is suggested that this cultivation activity be done in the classroom for 10 days, analysing the evolution of the sprouted remains (measuring their growth). This activity could also be done with garlic, lettuce, onions, or leeks. Links to videos: https://www.youtube.com/watch?v=EIasiDxriWQ; https://www.youtube.com/watch?v=G5gTMgJyEdc. If lettuce is grown, it is very important that the water is changed daily and the container is placed in a sunny spot. The water level should be about 3-4 cm.

Encourage students to measure the leftovers after two meals at home. If they have scales, they should record the weight of the leftovers. If they do not have scales, they can use a container to see and compare the level they reach over the two days. Students can take and share photos of the leftovers in the virtual classroom.

WWF has developed a program to combat and raise awareness of food waste.
Link:
https://wwfusfwwarriors.knack.com/food-waste-warriors?utm_campaign=wild-classroom&utm_content=food-waste-resources&utm_medium=web&utm_source=partner-site#program-dashboard/?utm_campaign=wild-classroom&utm_content=food-waste-resources&utm_medium=web&utm_source=partner-site

45 min

Micro-composting station

It is recommended to divide the class into groups of 2-3 students. The activity should be announced sufficiently in advance so that each group brings the necessary materials to carry it out:

- 2 x 2-litre soft drink bottles washed with water
- Wooden stick to stir the mixture
- Organic waste: vegetable waste, tea bags, coffee grounds, fruit waste, etc. (avoid meat, fish, and dairy waste).
- Soil: dry leaves, woody debris (e.g. branches, bark), eggshells, vegetable or fruit peels, etc.

Note: both organic waste and soil should be cut into small pieces.

Development of the activity:

1. Wash the bottles with water.
2. Cut one of the bottles at the neck with the scissors as it begins to narrow (see Figure 2.3.1). This bottle will hold the waste mixture for composting. Cut the other bottle in half (see Figure 2.3.1).

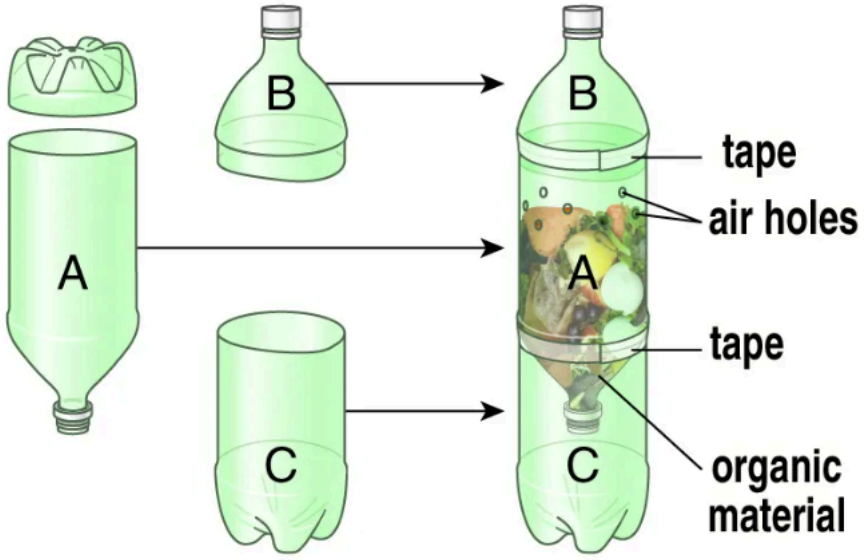


Figure 2.3.1. Station set-up. Source: Trautmann, N. M., & Krasny, M. E. (1998). *Composting in the classroom: Scientific inquiry for high school students*. Kendall/Hunt Publishing Company.

The base of the bottle will serve to collect any leachate that may be generated.

3. Pierce the first bottle at different heights to allow aeration and to take the temperature (see Figure 2.3.1). The cap of the first bottle (A) should be punctured to collect any leachate that may be generated.
4. The bottles are assembled as shown in Figure 2.3.1. An explanatory step-by-step video can be seen at the following link: https://www.youtube.com/watch?v=7pfDI0NDvc4
5. The station is filled in as follows:
   - 5.1. Add soil until the base of the bottle is covered (2-3 cm).
   - 5.2. Add a layer of recycled paper cut into small pieces (1-2 cm).
   - 5.3. Add a volume of organic waste chopped into small pieces (4-5 cm).
   - 5.4. Add a 1-2 cm layer of soil and a 1-2 cm layer of paper.
   - 5.5. Repeat steps 5.3 and 5.4 until 80% of part A is filled.
   - 5.6. Add a top layer of 1-2 cm of soil.

Parameters to be assessed:

Although the activity of creating the station can be carried out in a single session, it is requested that its evolution be monitored over a month. Thus, the following parameters will be evaluated:

- Temperature. Using a thermometer, the temperature of the compost will be measured at various heights and compared with the ambient temperature. To measure the temperature, the holes made in the bottles will be used. The temperature will be measured three times a week (e.g. Monday, Wednesday, and Friday). The evolution of the temperature will be evaluated over time, i.e. as the mixture composts.
    - You should be aware that the temperature of the compost mixture increases over the days due to the activity of the microorganisms that break down the organic materials in the compost pile. Factors affecting temperature: Proportion of green and brown materials, Aeration, and Humidity.
- Volume of the mixture. The initial height of the mixture in the bottle shall be marked with a marker pen. Each week, the height of the mixture shall be observed and marked, measuring the difference from the beginning with the help of a ruler.
    - You should be aware that the reduction in volume of the compost mixture over time is the result of the biological decomposition of the organic materials, the natural compaction of the pile, the loss of moisture, and the conversion of the material into a more stable humus.
- Weight of the bottle. With the help of a scale, the evolution of the mass of the bottle will be measured. This activity will be done once a week (e.g. on Fridays).
    - You should know that, at the beginning of composting, the mass is larger due to the presence of all the organic matter and water. As the microorganisms break down the materials, CO_2 and water are released, which reduces the mass. That is, the final mass is significantly lower than the initial mass due to biological decomposition, loss of water, and loss of volatile compounds. The volatilisation of compounds is the process by which certain substances are transformed from solid or liquid to gaseous state and released into the surrounding air.

Formative evaluation

To assess this topic, a short questionnaire is proposed to assess the students' understanding of composting.

Format: You can use tools such as Kahoot! or Quizzizz to make this quiz more interactive. In the case of paper-based quizzes, make sure that students have enough time to reflect on each question.
Estimated time: 10 - 15 minutes.

Review: At the end, go over the correct answers with the students to clarify any doubts and reinforce what they have learned.

Questionnaire:

1. What is compost?

   a) A type of chemical fertiliser.
   (b) Decomposed organic material used to enrich the soil.
   (c) A waste that cannot be recycled.
   (d) A type of soil found in forests.
   (Correct answer: b)
2. What materials are suitable for composting (choose two)?

   (a) Fruit and vegetable waste
   (b) Plastic
   (c) Dried leaves
   d) Glass
   (Correct answers: a and c)
3. Which of the following is NOT a benefit of composting?

   a) Reduces the amount of waste in landfills.
   b) Releases toxins into the soil.
   c) Enriches the soil with natural nutrients.
   d) It helps to reduce the need for chemical fertilisers.
   (Correct answer: b)
4. Why is it important to add "green" and "brown" materials in compost?

   a) To give the compost different colours.
   b) To balance the amount of nitrogen and carbon, facilitating decomposition.
   c) Green materials smell good, but brown materials do not.
   d) It is not necessary; all materials are composted equally.
   (Correct answer: b)

5. Which microorganisms are essential for the composting process?

   a) Bacteria and fungi.
   b) Butterflies and bees.
   (c) Cockroaches and mice.
   d) Fish and frogs.
   (Correct answer: a)
6. What is the best way to speed up the composting process?

   a) Add water and aerate the compost regularly.
   b) Keep the compost in a dry and airless place.
   c) Do not add anything to the compost once started.
   (d) Leave the compost unmixed for several months.
   (Correct answer: a)
7. What happens if there is too much moisture in the compost?

   a) Compost decomposes faster.
   b) Compost becomes smelly and slow to decompose.
   (c) It does not affect the composting process.
   d) It makes the compost more nutritious.
   (Correct answer: b)
8. What role do earthworms play in composting?

   a) They eat the compost.
   b) They help to break down organic materials.
   c) They make holes in the ground for the water to enter.
   d) They prevent the compost from mixing well.
   (Correct answer: b)
9. What do you do if the compost smells bad?

   a) Add more green materials.
   b) Stop adding materials.
   c) Add more brown materials and aerate the compost.
   d) Seal the compost to prevent odour from escaping.
   (Correct answer: c)
10. What do you get at the end of the composting process?

    (a) Chemical fertiliser.
    b) Compost, which is a natural fertiliser.
    c) More waste.
    (d) Potting soil.
    (Correct answer: b)

Feedback

Net Promoter Score (NPS) is a widely used tool to measure the loyalty and satisfaction of customers or, in an educational context, students. It measures the likelihood that students will recommend the subject or course to others.
How to analyse and apply NPS is explained below:

Development of the NPS question:

- Main question: "On a scale of 0 to 10, how likely are you to recommend this topic to other students?
- Follow-up questions: "Why did you select this score?" and "How can we improve this issue?

Collection of responses:

- Digital surveys: Use online tools such as Google Forms, SurveyMonkey, or Typeform to collect student responses.
- Paper surveys: Paper questionnaires are distributed at the end of the lesson for students to complete. A template for collecting responses with paper surveys is shown in the Annex.
- Interactive applications: Interactive applications such as Quizziz, Mentimeter, or Kahoot! are used to collect answers in real-time.

Classification of responses:

- Promoters (Score 9-10): Students are very satisfied and likely to recommend the subject.
- Passive (score 7-8): Satisfied, but not enthusiastic students; they could easily change their minds.
- Detractors (Score 0-6): Dissatisfied students who are unlikely to recommend the subject; they could provide constructive criticism.

Calculation of NPS:

- Formula: NPS = % of promoters - % of detractors.
- Score interpretation: NPS ranges from -100 to +100. A positive score (above 0) is generally good, and a score above 50 is excellent.

Analysing and using comments:

- Review the comments to understand the reasons behind the scores.
- Identifies patterns and specific areas for improvement among detractors and passives.
- Use the promoters' positive comments to reinforce the positive aspects of the issue.

Annexes

POSTERS



Food is not rubbish

SHARE

Food is not rubbish

MAKE IT COMPOST



Figure 2.3.2. Cut-out food poster – part 1



Figure 2.3.3. Cut-out food poster – part 2

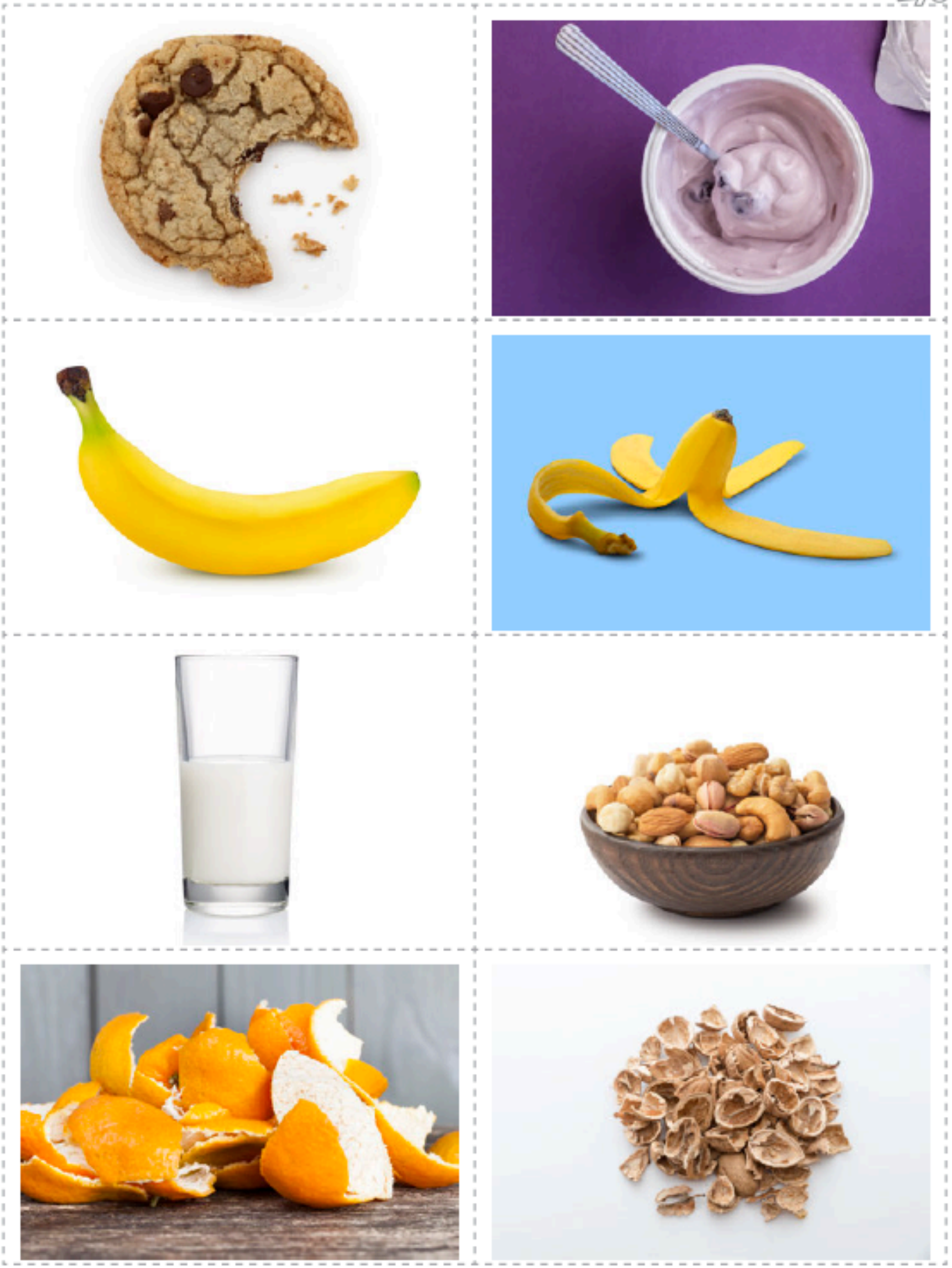


Figure 2.3.4. Cut-out food poster – part 3

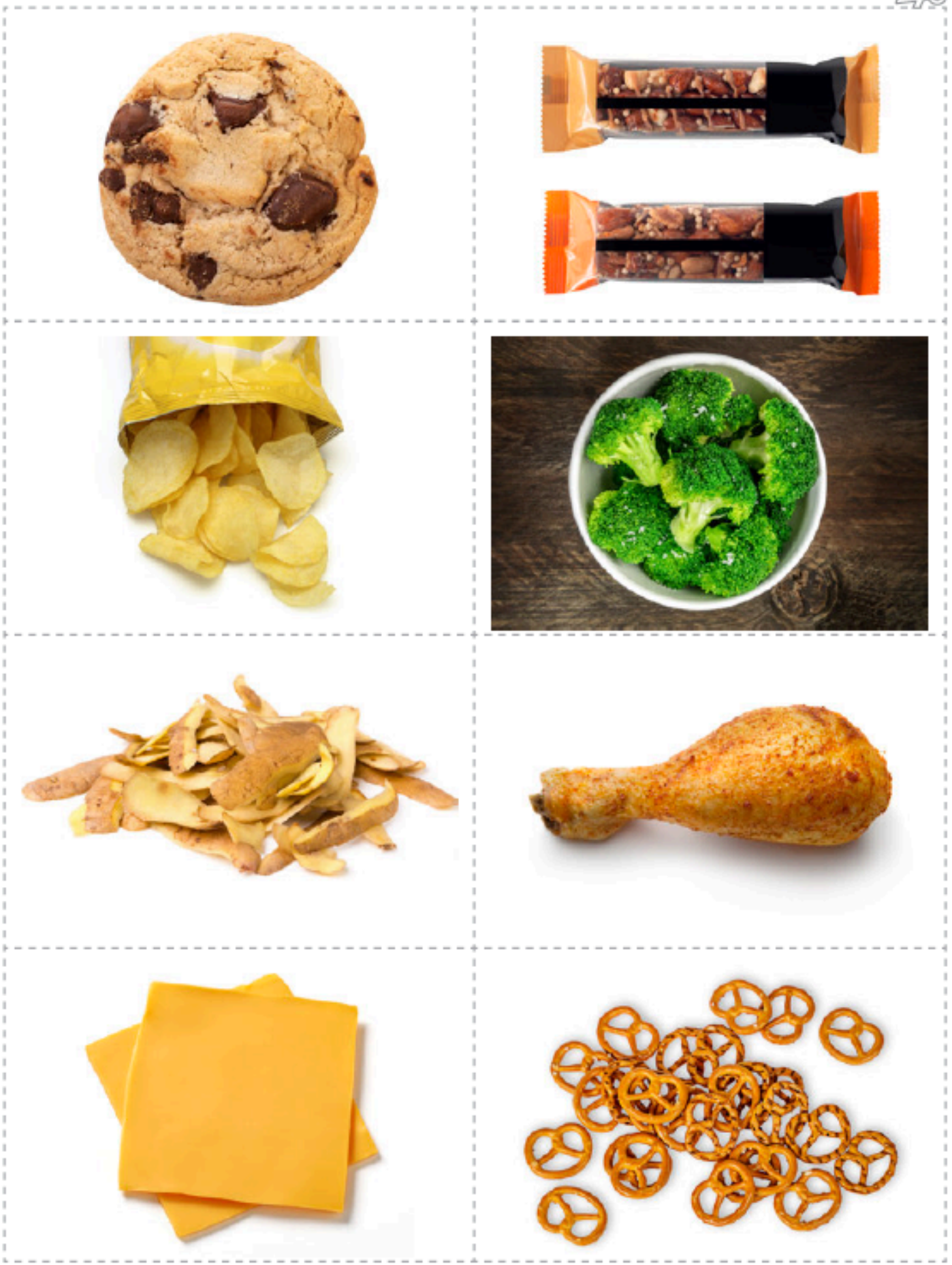


Figure 2.3.5. Cut-out food poster – part 4

QUESTIONNAIRE TO COLLECT FEEDBACK ON THE TOPIC

On a scale of 0 to 10, how likely would you recommend this subject to other students?

0	1	2	3	4	5	6	7	8	9	10

Not likely at all — Extremely likely

Why did you choose that score?

How could this issue be improved?