

Teacher manual

The school canteen & sandwiches

Lesson series, 120 minutes, tested with 14 year olds



Utrecht University

Global lesson plan

During this lesson, students will search for an okay sandwich that can be sold in the canteen. To do this, they research ingredients of the current sandwich being sold. We start with an exercise with a context that is familiar to all (the corona pandemic) so that students can master **systems thinking**. This involves **cause-and-effect relationships** between different variables and the nature of these relationships. After practising, a similar exercise follows, this time using systems thinking with the main topic: one ingredient of the **sandwich**.

After students have sufficiently mapped out their system, they devise a statement about their ingredient. During the following activity, opinions are clarified and exchanged: **arguments in motion**. In this way, students also get to see information from other groups who have researched other ingredients. After arguments in motion, students think about how everything they have heard can be used to develop a **new sandwich**. Finally, they briefly **pitch** this to the rest of the class and/or to the canteen personnel.


This lesson series is the concluding activity in a series on sustainability competences developed by teachers and science education researchers from the region of Utrecht, the Netherlands. There is also a lesson on the fashion industry and a lesson on collecting used phones.

Learning aims

The student booklet starts with the following information.

Learning aims

These lessons are about sustainability. We work on the following learning aims.



For sustainability, you can:

- recognise and map complexity
- think of future scenarios
- look from multiple perspectives
- think of ways to intervene
- collectively come to decisions

From a theoretical perspective, this lesson is designed to allow students to **practise mapping a complex sustainability issue**. To do this, they practise around a context that is familiar and close to them all: issues around **canteen food**. Central to this is a **tool** that teaches students how to engage in **systems thinking**. It uses terms actually applied by systems thinkers all over the world: *same* and *opposite* relations and *reinforcing* and *balancing* loops. There also is a focus on the normative side of things: what opinions are there in the classroom around such issues? This is not about winning (like in a debate), but rather about making clear what opinions individual pupils have (and possibly the underlying values: **values clarification**). In addition, it becomes clear to pupils that there are many ways of looking at this issue (**perspectives**), so there is room for **plurality**. Ultimately, these learning objectives align with two key sustainability competences formulated by Wiek et al. (2011): systems thinking competence and normative competence.

Planning

Part 1 (total: 65 minutes) – Systems thinking

15	Introduction and Exercise 1 (question 1, 2, 3, 4)
15	Exercise 2 (question 5, 6, 7, 8)
15	Text and searching for info (question 9, 10, 11)
20	Main exercise (question 12, 13, 14, 15, 16)
15	Break

Part 2 (total: 50 minutes) – Opinions and advice

10	Statement (question 17 and 18)
20	Arguments in motion and question 19
15	Designing a new sandwich (question 20)
5	Evaluation questions 21, 22, 23, 24

Description per teaching and learning activity

PART 1

Introduction and Exercise 1 (question 1, 2, 3, 4)

15 minutes

At the start of the lesson, briefly discuss with students what will happen during the lesson (see pages 2 and 3 in the student booklet). Briefly discuss the learning objectives related to recognising and mapping complexity (see above) and looking from different perspectives. After this, students start with **Exercise 1**. In this section, they practise **systems thinking** around a case we have chosen: the **corona pandemic**. They map out this system through a number of steps.

Question 1 requires students to read a **text**. You could do this in a plenary fashion if you feel this is necessary in the group, or you could have them read it out within the groups themselves. Meanwhile, students each grab 5 post-its, on which they write down **variables** from the story (1 variable on each post-it, a brief explanation of what a variable is is on page 4, at question 1).

Students share the variables they found at **question 2**, students choose 10 to stick around a **circle** they drew themselves at **question 3**. This is the first step towards their relationship circle, which will help them create their system. For this, a large flipchart sheet, markers and post-its are on the table for each group.

The second step to their relationship circle is to indicate the **cause-effect relationships** between the variables. They do this in **question 4**. It is important here that they are cause-effect relationships: one variable must cause an increase or decrease in the other variable. The arrow points to the effect. They should also think carefully about whether the arrow can also be drawn the other way round. In exercise 2, they are going to add system thinking terms to this.

Exercise 2 (question 5, 6, 7, 8)

15 minutes

Exercise 2 is about the **types of relationships** to be recognised in the system, and their effects on the system. In **question 5**, students think about the type of relationship (**S** from ‘*same*’; and **O** from ‘*opposite*’). So an **S** means that if one variable increases, so does the other, but if one variable decreases, so does the other. An **O** means that this relationship is reversed: if one variable increases, then the other decreases, and vice versa. **This is a clearer system than pluses and minuses**, because it indicates exactly what the relationship is. Also, the pluses seem to represent positive/desirable correlations and the minuses negative/undesirable correlations, which need not be the case. The letters **S, O** (and shortly **R** and **B**) come from systems theory and are used worldwide.

Now students will look at the **loops** that can be found in their system. In **question 6** they look at an example about this, in **question 7** they look for these loops in their own system. A **B**-loop indicates that the system balances itself (**B** from ‘*balancing*’, stabilising), while an **R**-loop is about a ‘*reinforcing*’ effect (strengthening). It is precisely these R-loops that stand in the way of sustainability: they cause the system to explode, keeps on increasing (or decreasing!). With an equal number of S-loops and O-loops, you have a B-loop, with an unequal number an R-loop.

The following summary of the letters/terms can be found in the student booklet, on page 6:

S	<i>Same</i>	If A increases, B also increases	For arrows
O	<i>Opposite</i>	If A increases, B decreases	
R	<i>Reinforcing</i>	The variables keep increasing or decreasing	For loops
B	<i>Balancing</i>	The variables have a stabilising effect on each other	

It is now important that students understand what the loops, variables, arrows and letters stand for. Therefore, in **question 8**, they have to tell their **story** for the loops they have found. The point here is to enable them to fathom what is actually happening according to their system.

Text and looking for info (question 9, 10, 11)

15 minutes

The pupils have now been able to practice systems thinking using a tool we have chosen with a context that is quite clear and recognisable to them. Since the actual issue, sustainability of ingredients in a sandwich, is quite a bit more complex, the pupils are going to sharpen and deepen their prior knowledge. To do this, they are given a short text corresponding to their ingredient.

Put a different ingredient on the table in each group: this is the ingredient that the pupils will be researching during this lesson! Think about cheese, egg, tomato, ham, cucumber and, of course, the sandwich itself (of course, choose a well-known sandwich in your national context).

After the groups have been given their ingredient, they are also given a short text with info about their ingredient (**question 9**). They read this, looking for variables and connections (as in the practice context of the pandemic). After that, students can search for new info if needed (**questions 10 and 11**). Search for some websites with information on the ingredients from the sandwich which you've selected and provide the students with these websites. Pupils may, of course, search further on their own!

Main exercise (question 12, 13, 14, 15, 16)

20 minutes

After the students have expanded their prior knowledge a little, it is time for the main exercise.

They will now map the sustainability issue for their ingredient using the same assignments as for the corona example. For **question 12**, students individually write down 5 variables (remind them of the preliminary work they have just done!). There are also three possible perspectives (the three Ps of sustainable development: *people*, *planet* and *prosperity*) in the booklet (page 9) to ensure sufficient depth and the full breadth of the issue.

Question 13 involves sticking a maximum of 15 variables from the group **one by one** (stress this for each group!) on a poster sheet (omit doubles, provide them with two prepared post-its of main variables to offer a starting point; think about 'number of stables', 'fertilizer', or 'emission of greenhouse gasses') and drawing relationship arrows between the variables. It is very important to structure this well, otherwise students will get lost in a confusing system. Before sticking on a new variable, have them draw the relationship arrows first!

For **question 14**, students name the relationships (**S** and **O**) and for **question 15**, they indicate the types of causal loops (**R** and **B**) in their system. Encourage students to find as many loops as possible; this can be difficult for them. Letters are again explained in the workbook (pages 9 and 10).

After students have created a sufficiently elaborate system, it is time for **question 16**, again explaining some loops with a story, 'If X grows, then Y increases, eventually decreasing Z', etc.

PART 2

Statement (question 17 and 18)

10 minutes

Part 2 further explores the school situation and the moral side of the issue. Ultimately, students base their advice with their systems and this moral enquiry in mind.

For **question 17**, students look for R-loops that can be found in their system, i.e. these make their ingredient less sustainable. On this, students devise a statement (**question 18**). Collect these statements by writing them (you could of course let students do this) on the board. If you notice that there are no suitable statements among them, you can use the following statement to make the arguments in motion a little more in-depth:

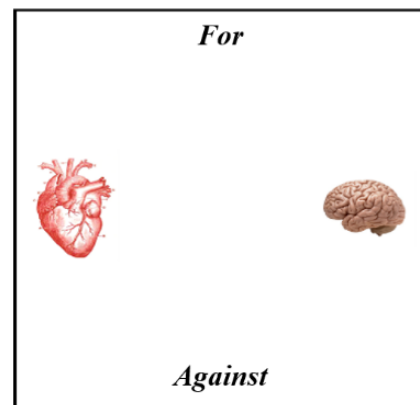
“All ingredients of the sandwich should come from our own country.”

Arguments in motion and question 19

20 minutes

We now start with **arguments in motion**. This is done using the self-devised statements from **question 18**. As a teacher, guide the arguments in motion process. You and the class can choose two or three statements from question 18 to use. Hang four papers on the four walls of the classroom: for and against (on opposite walls) and heart and head (on opposite walls). So your classroom will look like the one shown in the figure opposite.

You now introduce the statement you are going to discuss with the students. You then ask students to take their places on the line **for-against**. So you can stand anywhere on the line, the closer you are to ‘for’, the more you are in favour of the statement. Then introduce the **heart-head** line. This indicates whether the students made the choice by acting on their gut feeling/intuition (heart) or by thinking, made a rational consideration (head). So you get a ‘scatter plot’ of students in the classroom, their position indicating what they think of the statement and how they decided it.



Now it is good to ask some students to **explain why** they are standing where they are. Afterwards, you can also ask if they can stand in the opposite spot and, for example, question their neighbours there/tell them why someone would stand there. The aim in this activity is not to convince each other: all opinions are allowed and both reason and emotion are important drivers of argumentation! You can (if you have time to spare) further nuance the statement and ask students to move if they wish.

After arguments in motion, students can write down what new insights this gave them at **question 19**. What were new opinions for them? What did they not expect to hear from classmates? You can skip this question if you think it is not applicable or if there is a lack of time.

Designing a new sandwich (question 20)

15 minutes

Having now mapped the system and seen the range of opinions around this issue in the classroom, students are now ready to create a new design: they are going to **design a new sandwich**.

In **question 20**, students think about their new sandwich. It is important that they form this design using their system and arguments in motion: that's why we did those activities. In this way, their design will hopefully be better substantiated than if they had had to write it down right away.

The design is briefly explained to the other groups in the form of a **pitch**. The students get to tell group by group what they came up with (using the info from question 20). What does their new sandwich look like? Why? What is the name of their new sandwich? Guide this process so that the groups all get their turn. It would be especially valuable if you can organise canteen personnel to be present during the pitches, so the sandwiches might actually end up in the school canteen.

Evaluative questions 21, 22, 23, 24

5 minutes

A few more evaluation **questions (21, 22, 23, 24)** are included at the end of the booklet. Students answer these **individually**. They reflect on what they learned and what they liked and disliked

5 minutes to spare.

Teacher manual ‘The school canteen’

Version 1 – February 2024

Developed by

Teachers

Baukje Lobregt, Caspar Lapré, Coen Klein Douwel, Michiel Tolboom
Farel College Amersfoort, Grifland College Soest, Christelijk Lyceum Veenendaal

Researchers

Michiel van Harskamp, Marie-Christine Knippels, Wouter van Joolingen
Freudenthal Institute, Utrecht University

Contact details

Michiel van Harskamp

m.vanharskamp@uu.nl

This project received funding from the NRO (Nationaal Regieorgaan Onderwijsonderzoek), under grant number 40.5.18540.030