



Less plastic in the waste bin

Topics

Volume
Estimating
Arithmetic
Mathematical inference

Time needed

At least 90 minutes
(2×45 minutes)

To prepare before class

Worksheets for students,
blank sheets of paper,
universal Design Thinking
Wheel. Ask the students
to observe their own
behaviour for a week
and note down how
much plastic waste
(and of what types)
is thrown away at their
homes and in the school.
This information will be
used during their work
on the challenge.

Other teachers to work with

biology/nature teacher,
geography teacher, civic
education teacher, class
tutor

Take a look at

The student worksheet



The aim is to reduce the amount of plastic waste. Guided by the design thinking method, the students will estimate, then calculate and reduce the amount of waste they produce. They can then share their knowledge and experience with the whole school community. The decision on the purpose of these changes can be left for the students to make. You can also decide beforehand yourself or discuss it with the students at the beginning of the lesson. Most importantly, the chosen purpose has to be feasible.

Possible modifications

1. Depending on your possibilities, you can extend the task to other types of waste, e.g. glass, paper, metals.
2. You can also involve other student groups or even the whole school in this challenge.
3. You can extend the measurement period to a month or more.
4. If the method chosen by the students is successful, you can calculate by how much this could reduce the monthly or the annual cost of waste disposal (you can check how big the school waste container is, how often it is emptied and how much it costs to empty it).

Tips for teachers

Below, you will find some practical tips that will help you organise students' work on this particular topic. You can decide at what point you want to introduce the challenge: before discussing certain concepts or afterwards, as a summary exercise. If you use the challenge to introduce a new topic, try to make students intuitively arrive at the solutions on their own. Then sit down together and decide which of the solutions are most effective and why. If you use the challenge as a summary exercise, make sure the students refresh their memories concerning the theory behind it and show them at which stages the theory was actively used. In any case, remember to point to the practical application of the knowledge gained in the process. Suggest using the information gathered at each of the stages. You can also use other examples apart from those referred to in the scenario.

Stage 1: Empathising and identifying needs

The aim of this stage is to think about the needs of all students and of the teacher. Remember that at the end of the activity you should go back to the identified needs and check if they were met.

- During this stage, all the students can work together or they can be divided into smaller groups.
- Encourage the students to formulate questions on their own. If they have a problem with formulating questions, you can do it together with them. You can also prepare sample questions that will inspire your students. This is especially important if you are only beginning to work with your students using the DT methodology. You can suggest that the students think about:

what types of things they put into the waste bin on a daily basis,
whether any type of material constitutes a majority,
what their opinion on environmental protection is.



- Together, decide whether any of the students has specific needs or limitations that should be taken into account.
- The results of all discussions and decisions should be written down. In this way students will easily refer to them at subsequent stages.



Stage 2: Analysing needs and resources

The aim of this stage is to gather as much information and precise data (including exact numbers) as possible. This will constitute a point of reference for future work.

- From this moment on, students should be working in small groups.
- They should determine some basics at this point:
 - how to measure waste reduction,
 - which period they want to take into account,
 - whether there is a separate waste bin for plastics.
- If you introduce modifications, remember that you should ask additional questions.
- Let the students decide how to calculate the amount of plastics. It would be good if they found a common denominator for all types of waste, but it is also possible to count the number of bottles while keeping track of other plastic waste (e.g. forks and spoons) in grams. They can also count the number of pieces of plastic packaging or measure their volume.
- Remind the students that if they choose a variety of methods, they will have to provide a summary at the end of the exercise, taking into account all the chosen approaches.
- Decide whether the students will be responsible for establishing this information or you will provide it before the class. The list of the basic guidelines can be edited as needed.



Stage 3: Generating ideas

The aim of this stage is to generate ideas that lead to achieving the goal. This is not the time for finding the ultimate solution. Instead, students are to propose various solutions that will be later tested and refined.

- Decide whether you want to organise a general brainstorming session or divide students into groups.
- The aim is to get different concepts of what might meet the identified needs. There should be no bounds as to where the students go with their ideas.
- Encourage your students to think about replacements for disposable plastics, ways of reducing the volume of plastic waste, as well as the number or weight of the plastics used.
- Decide how ideas should be presented: as a drawing, collage or other graphic form, or as a simple description or table.



Stage 4: Prototyping

The aim of this stage is to verify how the presented ideas work.

- This is a key phase in your project during which you will make precise calculations. It is worth allocating enough time for this stage.
- Students should take a critical look at their proposals and choose the one that is realistic and best fits the needs of the group determined beforehand.
- In some cases students may find it difficult to calculate the volume, especially when it comes to water bottles. You can suggest various ways of measuring this: a cylinder volume calculation formula for bottles filled with water, putting squashed bottles into the smallest possible round containers, or putting bottles into a bathtub



full of water before and after squashing them. Of course it would be ideal if the students came up with more ideas of how to measure the volume.

- It is time to make calculations, provided that the amount of plastic waste was reduced.
- You can also tell your students that some types of plastic (e.g. bottle caps) can be collected separately because they can be sold.
- Encourage students to make sure that the chosen solution fulfils all the needs and assumptions before moving on to the testing phase.
- This is a good time to introduce changes and make improvements.



Stage 5: Testing

The aim of this stage is to test the chosen solution and put the selected idea into practice.

- Start with a general discussion of the projects prepared by each group. Use the summary questions provided below.
- Make sure that students present their projects in a way that enables their direct comparison.
- Depending on your possibilities, choose a set of projects or project parts that you can test in the classroom.
- Jointly determine the rules and the time necessary to implement the proposed ideas.
- Talk to your students about the pros and cons of the chosen measurement methods. Which one was the most accurate? Which one was the easiest?
- After the testing phase, jointly discuss the matter and decide whether the proposed ideas addressed the needs of the group and whether you will be using such solutions in the future.

Summary questions

Remember to devote some time for discussion. This can be combined with student presentations. Talk to your students about their working process and what they learned. You can make use of our list of questions or formulate your own set of questions to make students aware of what they did and how it helped them.

Useful questions:

What were your base assumptions?

What needs did you identify?

Which idea did you choose and why? How did this idea correspond to the base assumptions?

How did you make the measurements? Was every measurement method equally effective?

How did you divide work among group members?

Did everything go as planned?

Did you have problems? If so, how did you solve them?

Would you do some things differently next time?

How can you make use of what you learned in everyday life?

During the discussion it may surface that students made their measurements inadequately or inefficiently and their results are not in line with the base assumptions. Treat this as a learning situation: avoid giving students the correct answers, encourage them to explore on their own; make sure their group potential is fully exploited.