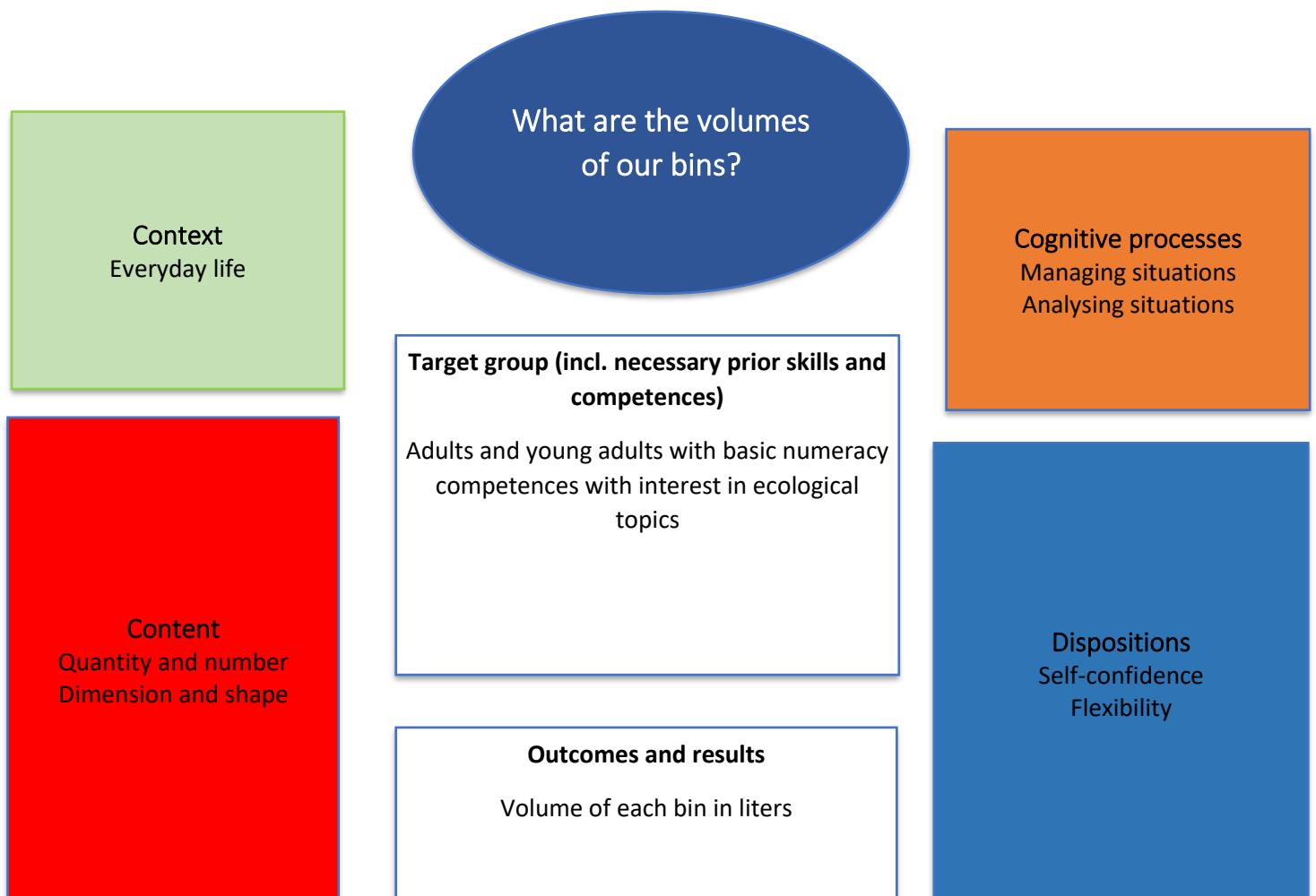


Garbage bins

In our home, we have many garbage bins: for PMD (Plastic, Materials, Drinks), for paper, for bottles with deposit, glass bottles without deposit, gray waste. Therefore, we buy different types of waste bags with different volumes. Sometimes, the waste bag does not fit, even though we bought the correct volume. How can we find out what volume we should buy?

Overview “Which waste bag fits into my bin?”



Main information

Content	Quantity and number Dimension and shape
Target group	Adults and young adults, students with basic arithmetic and digital skills being able to use a calculator
Learning intention	What is the intention of adults to face this problem? <ul style="list-style-type: none"> – Numeracy for personal and private purposes – Numeracy to understand society
Duration	approximately 1 hour
Material and resources	waste bins, waste bin bags, measuring cups, spreadsheet, laptop, calculator
Group size	Range from 5 to 30 learners
Problem statement	Finding out the volume of a bin can sometimes be hard
Working questions	<p>To address in this lesson</p> <p>What bins do learners have at home? How many bins do learners have at home? What kind of waste are the bins for? How many different types of waste bags are used? Does every bin need a waste bag?</p> <p>Further questions for classroom discussion:</p> <p>How can we reduce waste? What are the costs of waste? What, if any, is the financial benefit for the learner or the village when reducing waste? How is waste collected? How do you know when your waste is collected?</p>
Learning outcomes and results	The learners can estimate the volume of a waste bin or calculate it with a calculator. The learners can use information found on the Web to answer further questions regarding waste.
Reference to National Qualification Frame	Optional (country's decision)



Working plan

Time (minutes)	Description of content/activities	Material	Methodical and didactic information ¹
10'	<p>Activation</p> <p>The teacher asks the learners about their attitude towards garbage separation:</p> <ul style="list-style-type: none"> • What bins do learners have at home? • How many bins do learners have at home? • What kind of waste are the bins for? • How many different types of waste bags are used? • Does every bin need a waste bag? 		Questioning
10'	<p>Estimation</p> <p>The learners work in small groups. Some groups fill waste bins with water to find out the volume. Other groups will fill waste bags to find out their volume.</p> <p>Quick learners or learners that aim to go to further education, can try to calculate the volume of waste bins that are cuboids (rectangular prisms).</p>	<p>One waste bin per group of two</p> <p>Waste bags</p> <p>Measuring cups (preferably a liter)</p>	<p>Hands on learning</p> <p>Finding out volumes is fun!</p> <p>Collaborative learning</p> <p>Low floor high ceiling activity</p>
10'	<p>Learning</p> <p>The learners fill in a table (on whiteboard, in Excel, flipover) with the results of the whole class.</p>	<p>Whiteboard or Excel or another spreadsheet or flipover</p>	Hands on learning

¹ for description and explanation of kinds of tasks, HITs and other background information please consult the teachers'/user's guide



30'	<p>Calculation</p> <p>The learners measure the sides (and circumference) of waste bins. Have students use a calculator to find the volume of a cuboid and cylinder form of waste bin. https://www.wolframalpha.com/input?i=volume+cuboid The learners compare the results with the estimations.</p>	Computer/laptop/ mobile phone calculator	Hands on learning Collaborative learning
	<p>Transfer</p> <p>At home: The learners find the volumes of their waste bins at home. Do they buy the best fitting waste bags for each bin? See also further questions</p>		



Suggestions for the teacher/user

The example presented here should be considered as exemplary and inspirational material presenting a guideline with a high range of possibilities of adapting those suggestions to a specific group of learners or an individual learner with his or her very personal requirements.

In concrete terms, the example (Which waste bin bag fits into my bin?) could be adapted these ways:

- Duration: In many European countries, the separation of waste is an important topic. This might not be the case in some of the learners' countries of origin. If this is the case, the phase of activation could be longer as it might be necessary to explain the system and to clarify unknown vocabulary.
- Individualization/ Level of difficulty: With the support of the teacher, very advanced learners can try to calculate the volume of a waste bag using the formula from appendix 1. They can work in small groups and do the calculations in excel.
- Further or additional material:
 - As 1 liter corresponds to 1 dm³, teachers can also give an overview on converting hollow dimensions.
 - The learners can find other cuboid or cylindrical objects at home for which the volume can be calculated (pots, laundry bin, pool, cupboards...)

Our educational activities aim at numeracy skills being not only memorized, but first of all being practiced and functionally used by the learners in daily life or/and vocational situations. It is therefore recommended to implement the idea of HITS² (higher impacts of teaching skills) as far and often as possible: ...

- ... work with concrete and authentic material that learners will recognize from everyday life situations.
- ... ask the learners questions and let them raise questions themselves. It can be crucial to discuss numeracy themes, contexts and numbers.
- ... think of possible ways of transfer: Being able to estimate and calculate volumes is a useful skill in many everyday life situations (cooking, water usage, ...) This example is also intended to illustrate the participants to reflect on the topic of waste, waste avoidance and how they deal with it themselves.

² For general information and explanation on HITS please see teachers'/user's guide



Appendix 1

Background information for teachers, not for students.

A formula exists for calculating the volume of waste bins. For waste bin bags that are filled, a model for the volume V (in liters) is:



$$V = a^3 \cdot \left(\frac{b-x}{3,142 \cdot a} - 0,159 \right)$$

Such model can be explored in Excel by

A1 = a B1 = b C1 = x
A2 = B1-C1
A3 = 3,142* A1
A4 = A2/A3 - 0,159
A5 = A1^3*A4

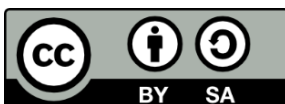
Appendix 2



Left to right: PMD, paper, general waste.



Paper, general waste, measuring jug.





The second one is an alternative for a measuring jug (a water cooker). Is it precise enough?



Left: four waste bins in a kitchen (bottom to top): glass bottles no deposit, bottles with deposit, paper, gray waste (general waste).

Right: two GFT waste bins in kitchen (GFT = groente, fruit- en tuinafval = compostable waste from vegetables, fruit and garden). The one on the bottom of the picture is for compostable waste that goes in the garden, the one on the top of the picture is for all other compostable waste (e.g., cooked vegetables, bones, meat, cheese rests, boiled tea leaves, garden weed that needs higher temperature to avoid spreading, bread, etc.)



Left: big waste bin (approx. 60L) for PMD. Right: waste container for paper (approx. 240 L?)



Waste bin bags (left bottom and top: 20L, right 60L).

Also for further exploration:

Food bags (how many litres?)

What does and does not fit in a food bag (how many slices of bread, which pieces of fruit, etc.)?

