

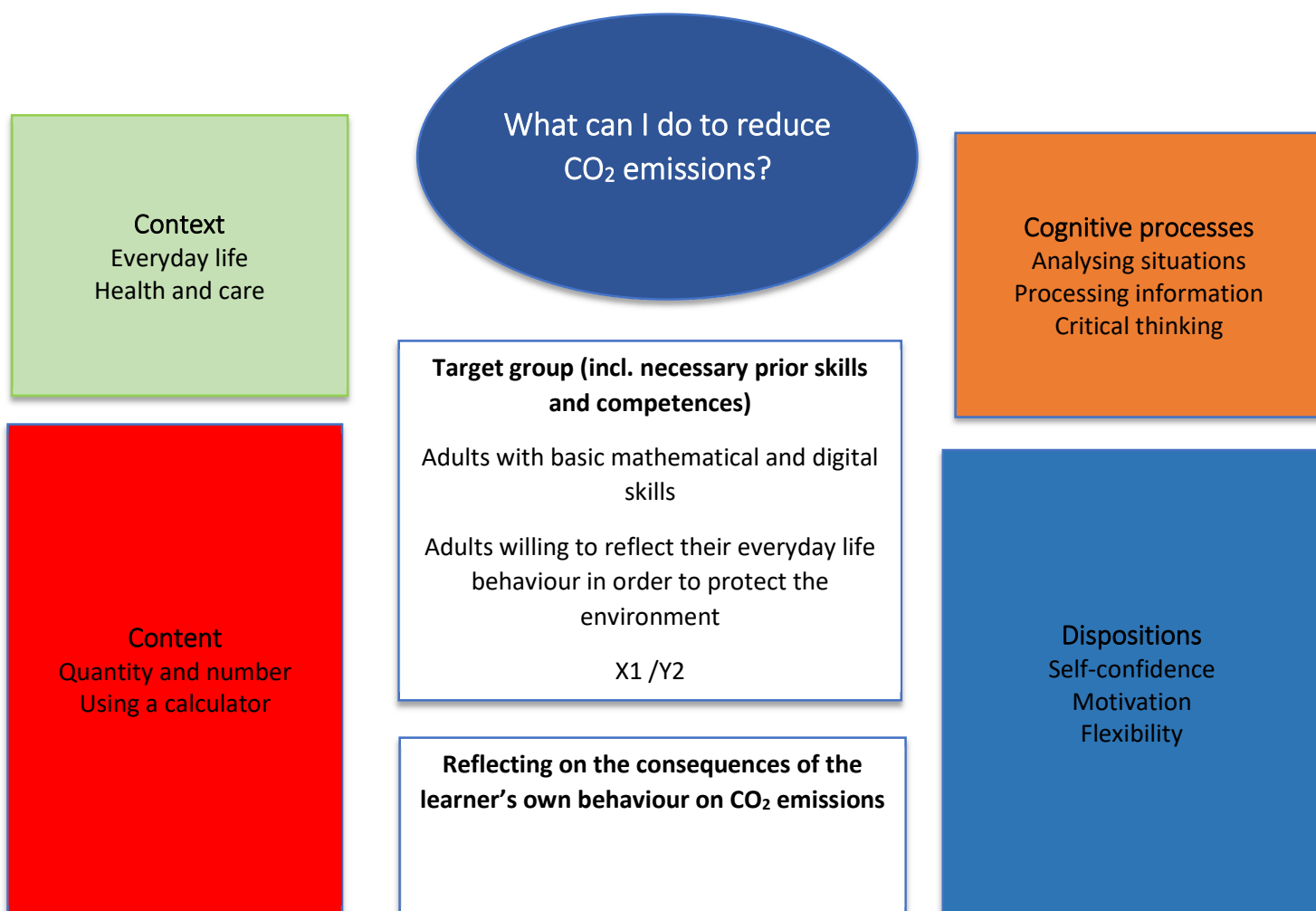
GREEN THINKING

How much CO₂ can I save by...

Climate is changing. We can see the effects of climate change in our own lives. It is getting hotter and hotter, and we are experiencing more droughts, floods and storms. The main reason for this is that we are releasing too much greenhouse gases – such as CO₂ – into the air. These gases trap heat from the sun and make the world warmer.

But we can all do something to reduce the CO₂ emissions and help to protect our planet. What about simply leaving the car behind and walking or biking to work instead? Let's have a look at how much CO₂ we can save by living an eco-friendlier lifestyle.

Overview "HOW MUCH CO₂ CAN I SAVE BY..."



Main information	
Content	Quantity and number (calculating with large numbers, calculation with digital numbers) Using digital skills (calculator/smartphone) for the calculation steps or for checking the results
Target group	Adults with basic arithmetic skills being able to use a calculator. Adults willing to reflect their own behaviour in environmental matters (means of transport, food).
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	Approx. 4 lessons
Material and resources	Lists of activities, picture cards, various worksheets, graphs,...
Group size	Up to 10 learners
Problem statement	CO ₂ emissions are primarily caused by burning fossil fuels. By applying mathematical calculations and understanding f. ex. the relationship between fuel consumption and CO ₂ emissions, learners can make informed decisions to reduce their carbon footprint.
Working questions	Which human activities produce the highest CO ₂ emissions? How can you compare the CO ₂ emissions of different means of transport? How can you compare the CO ₂ emissions of different dietary styles? How can you reduce your carbon footprint? How can we calculate with large numbers? How can we calculate with digital numbers? How can you verify results with a calculator?
Learning outcomes and results	The learners can calculate and compare CO ₂ emissions associated with different means of transport and dietary styles. They understand the environmental impact of their choices in everyday life.
Reference to National Qualification Frame	Optional (country's decision)



Working plan

Time (lessons)	Description of content/activities	Material	Methodical and didactic information ¹
15 min	<p>Activation</p> <p>The learners should understand that CO₂ emissions are primarily caused by burning fossil fuels, such as gasoline in vehicles and that by reducing fuel consumption, we can effectively reduce CO₂ emissions.</p> <p>First the learners collect human activities which are responsible for CO₂ emissions (f. ex. transportation, energy production, industrial processes, deforestation, livestock...)</p>	Flipchart	<p>HITS</p> <p>structuring lessons questioning cognitive activation</p>
15 min	<p>Estimation – ranking</p> <p>The learners work in small groups. They get a list of various means of transportation / different types of food and the estimated CO₂ emissions for each item. The learners rank the activities in order of CO₂ -emissions, starting with the activity that has the highest emission.</p> <p>The different groups can work together to discuss and justify their rankings.</p>	<p>List of means of transportation / food. List of CO₂ emissions The teachers choose the items from the list depending on their assessment. (Appendix 1)</p> <p>(Alternatively: picture cards)</p>	<p>HITS</p> <p>collaborative learning cognitive activation metacognitive strategies</p>
45 min	<p>Learning – revision</p> <p>If necessary, the learners reinforce their basics of arithmetic (addition, subtraction, multiplication) with large numbers and decimal numbers.</p>	<p>Worksheets (Appendix 2)</p> <p>Calculator, smartphone (optional)</p>	<p>HITS</p> <p>worked examples differentiated teaching</p>

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



45 min	<p>Learning</p> <p>The learners calculate the CO₂ emissions for</p> <ul style="list-style-type: none"> • different means of transport car – car car – bike plane – train – car ... • different dietary styles • purchasing local or imported • ... 	<p>Worksheets</p> <p>(Appendix 3)</p> <p>(Appendix 4)</p>	<p>HITS</p> <p>worked examples differentiated teaching</p>
30 min	<p>Transfer</p> <p>The learners are able to quantify and compare the CO₂ emissions associated with different modes of transportation and dietary styles. They understand the environmental impact of their choice. They reflect on their own behavior.</p>	<p>Online-tools (carbon footprint calculator) (Appendix 5)</p>	<p>HITS</p> <p>questioning feedback</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.

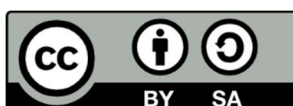
In concrete terms, the example “HOW MUCH CO₂ CAN I SAVE BY ...” could be adapted these ways:

- Duration: Depending on the prior knowledge of the learners, the duration of this example can vary. Especially the activation of the learners could require more time if they are not yet so familiar with the topic climate change and CO₂ emissions. It also could be useful to use visual aids such as graphs, diagrams or infographics to illustrate the concepts of CO₂ emissions and the calculations involved.
- Individualization: Depending on the learners’ prior skills, the trainer should repeat and train the capacity of written addition, subtraction or multiplication. Therefore, additional material could be necessary.
- Level of difficulty: This example contains calculations with large numbers and digital numbers. It is necessary to adapt the examples to the learners’ skills. Some learners can calculate the results without calculator and use it afterwards only to verify the answers. Others might use it to perform the calculation directly.

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. The learners can be engaged in group discussions where they can share their thoughts, ideas and questions. This allows peer-to-peer learning and promotes active participation.
- ... think of possible ways of transfer: These calculation examples should allow the learners to develop an understanding of the environmental impact of their own everyday life decisions. Once again, depending on the (digital) skills and the interest of the learners, the teachers can incorporate online tools such as an ecological footprint calculator.

² For general information and explanation on HITS please see the teacher’s/user’s guide.



Appendix 1

Transportation: What are the CO₂ emissions per passenger kilometre using the ...

Car	147 g CO ₂
Train	57 g CO ₂
Bicycle	0 g CO ₂
Bus	29 g CO ₂
Plane	271 g CO ₂
On foot	0 g CO ₂

Source: [CO₂ durch Verkehrsmittel im Vergleich](#) | [Mein Klimaschutz \(mein-klimaschutz.de\)](#) [24.06.2023]



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Food: What is the CO₂ emissions of 100 grams of...

Hamburger	3068 g CO ₂
Fried fish	820 g CO ₂
Grilled sausage	1568 g CO ₂
Pasta	152 g CO ₂
Green Salad	70 g CO ₂
Vegetarian Schnitzel	592 g CO ₂

Quelle: [Climate impact of CO₂ Potatoes \(foodfootprint.nl\)](#)[24.06.2023]This work is licensed under CC BY-SA 4.0. To view a copy of this license, visit <https://creativecommons.org/licenses/by-sa/4.0/>

Food: What is the CO₂ emissions of 100 grams of...

French fries	615 g CO ₂
Potatoes	92 g CO ₂
Chicken	1087 g CO ₂
Kiwi	70 g CO ₂
Beefsteak	3134 g CO ₂
Broccoli	134 g CO ₂

Quelle: [Climate impact of CO₂ Potatoes \(foodfootprint.nl\)](#)[24.06.2023]This work is licensed under CC BY-SA 4.0. To view a copy of this license, visit <https://creativecommons.org/licenses/by-sa/4.0/>

Appendix 2

Calculating with large numbers.

Calculate and verify the results with the calculator.

a) $8745 + 5321 =$

b) $9876 - 5432 =$

c) $3562 + 8956 - 2187 =$

d) $345 * 6 =$

e) $786 * 4 =$

f) $234 * 6 =$

Results:

2070	10331	14066
1404	4444	3144

Calculating with decimal numbers.

Calculate the price for your shopping list. Verify the results using a calculator.

Apples 2,50 €

Bread 1,80 €

Milk 1,29 €

Cheese 4,35 €

Yogurt 1,24 €

The purchase costs 11,18 € 18,11 € 11,81 €



Appendix 3

The distance between Vienna and Munich is 400 kilometers. There are various modes of transportation available for a trip from Vienna to Munich:



CO₂ emissions: 0,27 kg per kilometer

400 kilometer * 0,27 kg = **108 kg**

The airplane has a CO₂ emissions of 108 kilos.



CO₂ emissions: 0,06 kg per kilometer



CO₂ emissions: 0,15 kg per kilometer

[Fotos: www.pixabay.com]

How much CO₂ do the train and the car produce? Use the calculator.



Appendix 4

Calculate: How much CO₂ do the two menus generate?

Menu 1:



Hamburger: 3086 grams CO₂



Frenchs fries: 615 grams CO₂



Salad: 70 grams CO₂

Menu 1: _____ grams CO₂

Menu 2:



Chicken: 1087 grams CO₂



Broccoli: 134 grams CO₂



Pasta: 152 grams CO₂

Menu 2: _____ grams CO₂

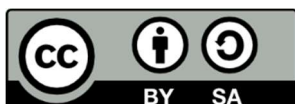
[Fotos: www.pixabay.com]



Appendix 5

Online carbon footprint calculator:

<https://www.co2-rechner.at/> [26.06.2023]



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