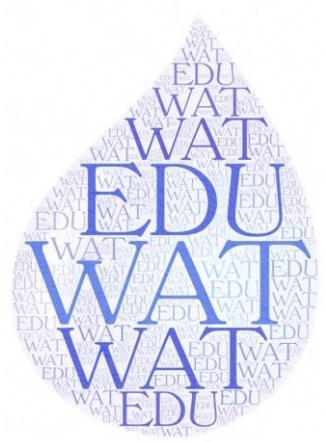

HOW TO GET WATER IN DISTANCE LEARNING

Education of elementary school pupils for future challenges connected with water and water management issues

Educational materials for distance learning

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HOW TO GET WATER IN DISTANCE LEARNING

Educational materials for distance learning

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The project outputs can be downloaded in digital form in PDF format at:

www.watedu.eu

Selected outputs are also available on the website www.ireas.cz

Prague, 2021

Introduction

The Wat.Edu project, whose supplementary material you are now holding in your hands, aims to create innovative tools and materials for education in the field of water and water management. At the time of project preparation, we had no idea how big a role online tools and alternative forms of teaching, including the flipped classroom model (in class vd. Out of class), would play in the education of elementary school pupils, even in topics such as motivating pupils to distance learning. The original focus of the project thus led to the creation of a handbook with innovative content and activities to expand face-to-face learning. In the next phase, an e-learning toolkit was developed, which in the form of online / offline games provides the opportunity to introduce pupils in a playful way to topics such as water purification, global water consumption or the connection between water and art. Alternatively, it can be used for non-traditional knowledge verification.

In the context of the COVID-19 pandemic, this support has proven to be insufficient given the current need of our target group – teachers in elementary schools. Already during the workshop, we tried to show how to approach distance learning, because it requires different methods and content. Our next steps led to an analysis of how schools are dealing with online teaching in the field of water education. It soon became apparent that any support for teachers was welcome, and so the idea and basis of this handbook emerged. Gradually, we modified the existing activities developed by us in the Wet.Edu project and proceeded to create new ones that could be applied in distance learning. The aim was, ideally, to replace or supplement frontal teaching in distance learning and at the same time motivate students to self-education. This material aims to expand students' competences in a broader sense than just being able to switch on online learning, e.g., via MS Teams. The result of our efforts is this educational material, which contains a set of activities developed by us and tested together with schools, suitable for use not only in distance learning. Each activity contains a brief description and a more detailed description of how to implement it in distance learning. It can also be used as a basis for project days or outdoor workshop activities.

May you continue to enjoy teaching and be inspired by this publication to teach water-related topics.

On behalf of the authors

Jan Macháč, Ph.D.
IREAS, Institute for Structural Policy

Contents

Find a disturbed aquatic ecosystem, map it and design change!

Goal of the activity *(Thanks to this activity, the students understood…)*	Documentation of a severely disturbed aquatic ecosystem leads the student to realize connections associated with the cause of the damage, at the same time the assignment leads him to an active approach to what is happening around him. **Pupils will learn how to find solutions leading to improvement of disturbed ecosystems.**
Material	Internet connection, camera, writing aids (crayons, markers, watercolours), papers
Time	**Approximately 42 hours**. Alternatively, it can be applied on a smaller scale, focusing only on certain phases. Alternatively, it can be spread over several subjects, school years or implemented as activities where individual teams of pupils or classes build on each other.
Form	**Project work**, documentation of a disturbed ecosystem, consultation with classmates and the teacher, presentation of results (proposal of possible measures).

Introduction to the activity

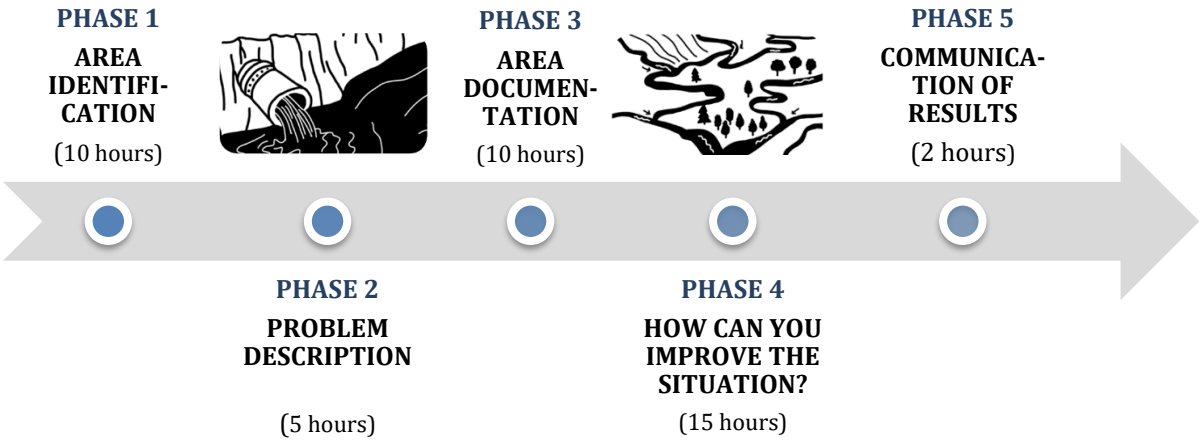
Ecosystems around human settlements are often disturbed. Pollution and environmental degradation affect quality of life significantly.Neglected and damaged areas often reduce the attractiveness of the wider environment. It is not necessarily just damage that results from current activities. It can also be old burdens, brownfield sites or problems that have not been addressed for years, which gradually lead to a deterioration in living conditions that, without intervention, will lead to a decline in biodiversity, etc.

The aim of the activity is to realize the complexity of the problem on the basis of own experience and analysis of the territory, to apply knowledge and gain new information when designing solutions to eliminate the problem. Students will learn how to document a severely disturbed aquatic ecosystem and how to find a source of water pollution / degradation in their own city or surroundings. It can be reduced flow, floodplains, chemically / physically / organically polluted watercourses / streams / lakes / ponds, etc. The survey is either conducted through consultation with parents / teachers / classmates or usin Internet resources.

Phase 0: Activity preparation and introduction to pupils

In class (during online meeting): Introduce the whole activity. Explain the objectives – the nature of the activity – to the pupils. The pupils can be motivated, for example, by the school providing the work results to municipality representatives, or the pupils presenting most successful projects directly. There is therefore the possibility of a real environmental improvement on the basis of projects developed. Students can also be motivated by a related made-up or real story which gives them a sense of improving their surroundings.

Out of class: Pupils explore their surroundings, become aware of problems and look for suitable sites to address. This can be helped not only by the teacher, but also by their own family or their experience of leisure activities, during which they may encounter a disturbed ecosystem regularly.



Phase 1: Area identification

Out of class: Following the initial selection of the area, a closer analysis of the territory takes place, in which key data about the affected area are collected. First, the study area is defined precisely. This is followed by a mapping of the status and specifics of the study area. Among other things, this phase includes: delimitation of the river basin (where the source flows from, in terms of the river), the number of inhabitants in the locality tied to the river, etc.

Books in the school/local library, data from the Internet, specialized portals and databases can be used as sources. An important competence that students acquire is the ability to search for appropriate and necessary information and data sources.

In class (during online meeting): At this stage, the teacher should provide feedback for the pupils and show them any additional data sources they are not aware of. It is beneficial to spend some time together on, for example, advanced internet searches. However, it always makes sense to start with skills that pupils already have. The more proficient ones can then

pass on tips on how they did the search themselves first. The teacher should then show other features with examples so that pupils can try them out straight away.

To emphasize the importance of mapping, it is possible to use real-life examples of where this phase was skipped, leading to a failure of the next steps.

Phase 2: Problem description

Out of class: The pupils analyse the problem in depth. The aim is to find the source of pollution or the reason why the current unsatisfactory situation has been reached. For a deeper understanding of the problem, a comprehensive approach is advisable. Thus, it is appropriate to address both the natural and technical as well as the social aspects of the investigation. In order to eliminate the problem in a sustainable way, it is also advisable to address topics such as inhabitants' preferences and their relationship to the site and the problem, maintenance and financing of measures, etc.

In this way, students can apply a wide range of methods to investigate the issue: in addition to secondary data – research articles, interviews and literature – they can conduct their own interviews not only with experts, representatives of public authorities and NGOs, but also pay attention to local residents and other key players.

In class (during online meeting): It is advisable to give pupils space to present the problems they have identified and let them discuss them among themselves. They may face similar problems. They can thus inspire each other in the discussion. Pupils learn to present and select key points. The teacher then aims to give feedback. The most important problems (impacts) and reasons leading to the current situation should be identified, determined and explained.

The teacher should provide all instructions related to the next two phases, which are mostly connected with the out-of-class form.

Phase 3: Area documentation

Out of class: The study area is visited one more time by the pupils to prepare documentation (take photos, make short videos, etc.). It is recommended to combine outdoor activity with time spent by the computer. Besides primary sources (own photos, videos, etc.), secondary sources such as photos, news items from newspapers / internet / TV or scientific reports can be used. This means that the pupils will have to go out and take pictures of the site, edit the photos and put them together with other documents and data sources. Groups of pupils can share different knowledge, develop tasks and inspire each other in real time. They can share the materials via, e.g., cloud storage or e-twinning.

In class (not during the pandemic): It is possible to use computers at school to edit the videos or photos. In many cases, schools are equipped with better software. These activities can be connected with IT classes. One of possible additional outputs could be, e.g., websites informing about the current state and suggested change (see Phase 4).

Phase 4: How can you improve the situation?

In class (optional): In this phase, it is important to consider the complexity of different problems and sources of pollution. It is recommended to discuss the problems with pupils again, to give them information and inspiration to design possible change. It is not necessary to show them exactly the same problems from other cities and thus to limit them in their creativity; it is more about motivating them. Without a certain level of inspiration, it is not possible to reach the goal with some types of problems.

Out of class: Two different activities are recommended for the pupils before starting to design their own solutions. They should think about the functionality of the ecosystems and set requirements for how the area should look and what type of ecosystem services it should provide. After this step, an analysis of similar revitalizations using an internet search and a literature review is recommended. Based on these two activities, it is much easier to propose measures that lead to an improvement to the study area. Pupils should design measures that lead to an improvement to the situation/site/ecosystem in the form of pictures, maps and illustrations with appropriate descriptions. It should be clear from the description how they would approach the remediation of the situation.

In class: It is important to provide time and feedback during the designing of the measures in the form of individual or group consultations. The length and frequency of such support depends on the complexity of the selected area and problems solved by the pupils.

In this phase, it is important to consider the complexity of different problems and sources of pollution. It is recommended to discuss the problems with pupils again.

Phase 5: Communication of results

This stage should focus on how to present or communicate the results. Pupils should prepare the final output from the activity now. It depends on their age and ability. The output should be in the form of a basic presentation, report, leaflet, poster, audio or video document or basic webpage. In some cases, other types of outputs such as an exhibition of models or drawings are more suitable. In case the suggested changes/measures are meaningful, it makes sense to present them to a wider audience and/or municipality representatives.

Out of class: Pupils prepare the output based on the teacher's instructions or preferences. As described above, there are many different types of output that can be used. Sometimes it is good to give plenty of freedom of choice, but sometimes it is better to narrow the choice or require a specific output that is consistent with further use and promotion. It also depends on links to other subjects such as IT or art classes. The whole activity takes a lot of time, and it is important to motivate the pupils in this final stage. There is a relatively high risk of decreasing concentration and motivation during this activity.

Inspiration for students: Applications/webpages are innovative tools that can be used very easily for creation of an online book containing all your documentation (photos, newspaper articles, etc.). It is possible to upload all possible types of materials and to arrange them according to templates and needs. Pupils can use, e.g., https://www.bookcreator.com or https://app.mural.co .

In class: The finishing of this activity should be linked to an evaluation of the whole activity. It may transpire that the path to solving problems is not always easy, but if enough attention is paid, most problems can be solved or appropriate measures can be proposed.

At the end all outputs can be presented to other pupils from other years, parents or a wider audience. This activity should be connected with project days, etc.

Water in your free time? Capture it!

Goal of the activity *(Thanks to this activity, the students understood…)*	Pupils will learn the interconnection between water and their daily life through their favourite sport activity. They should understand the ways of water use in daily activities such as sports and realize that water is used or produced every time, even by the human body. **This activity raises pupils' awareness of water consumption and demand related with different free time activities. Water is important not only for drinking and hygiene. It is part of most of our everyday activities.**
Material	Internet connection (access to websites containing basic information about water needed for sports facilities, e.g., watering stadium lawns), pencils, paper, camera, physical activity
Time	**Approximately 5 – 7 hours**
Form	**Individual/team project work**, pupils document their favourite sport, and they try to find the connection to water within it. They can find more connections in it (Sweat, production of t-shirt in terms of virtual water, watering of grass on football field etc.)

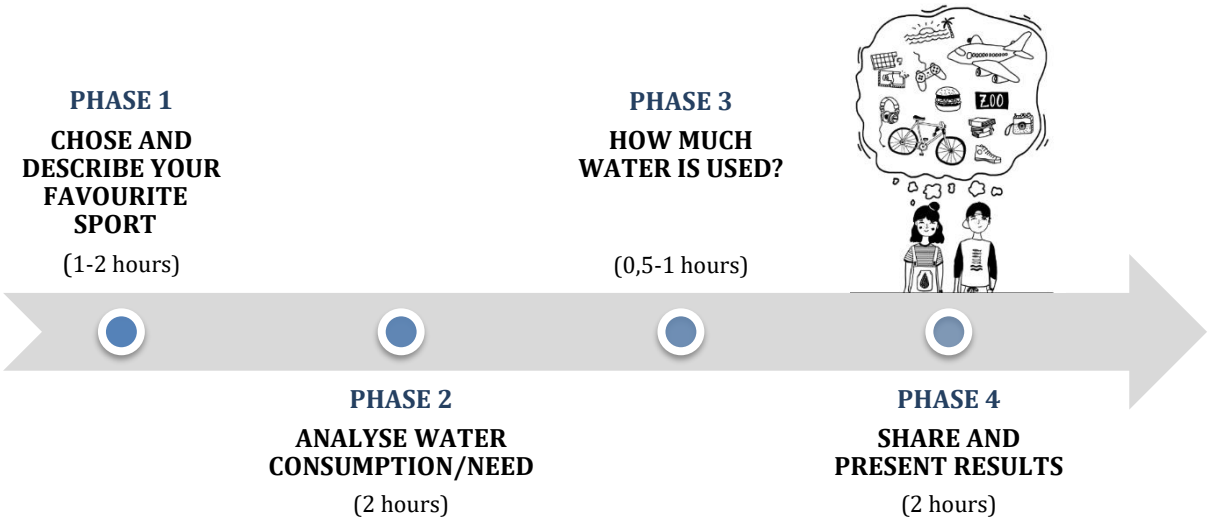
Introduction to the activity

The topic of water consumption is often introduced to pupils only in connection with water for drinking and hygiene purposes at home. Although there is a shortage of good quality water (drinking water) in parts of the world, Europeans live in relative water wealth. It is important to remember that water consumption at home alone is only part of the total. Water is the basis for most of the products and food we buy and is also linked to all the services we use. Without even realising it, by buying, for example, coffee beans, we have indirectly consumed water in a part of the world that was necessary to grow the coffee, process it, import it into our country and then buy it in the shop.

This activity connects sports and water (sweat, rivers, football/grass, etc.). Pupils should choose their favourite sport and identify water in it. Where and in which condition can water be found in sport activities? Is it the water we drink? Is it the water needed for the t-shirt production process? Is it water we sweat?

Phase 0: Activity preparation and introduction to pupils

In class (during online meeting): Introduce the whole activity. Explain the objectives – the nature of the activity – to the pupils. They have the opportunity to analyse their favourite activity from another aspect. Even though it is possible to measure the real water consumption in some of the activities, most can be analysed only using secondary data. The analysis canbe made in groups of pupils or individually based on the age. The pupils can be inspired with several examples about water consumption in different free time activities.



Phase 1: Chose and describe your favourite sport

Out of class: At the beginning, each pupil/group of pupils should identify his/their favourite sport or other activity in case sport is not relevant to them in their free time. After that, they should describe their favourite sport using words, pictures, photos from newspapers and gather together what they like about their favourite sport on paper or in an online environment, where they can also make a poster.

Similar to the previous activity, online tools and platforms such as Book Creator, Mural or Miro can be used for putting together the materials describing the favourite activity.

In class: At this stage, the teacher should collect the topics (sport activities or other activities) selected by the pupils and provide them with feedback.

Phase 2: Analyse water consumption/need

Out of class: In this stage, when the pupils have described their favourite sport activity, they should go out and practise it. As they are practising the sport activity, they should document the moments where they think water is used/ produced. Also, they should describe in which form it is and why (liquid, solid, gaseous). As they are noticing water in their sport activity, they should also capture these moments with a camera.

Phase 3: How much water is used?

In class: Before providing time for pupils to analyse the water consumption, it makes sense to lecture or discuss about different types of water consumption related to free time activities (e.g., drinking water, water used for producing sport equipment, clothes etc.). Different types of water footprint calculators are available online.

Out of class: Pupils should try to calculate how much water their sport needs.

- Virtual water needed to produce their sport clothes – https://1url.cz/8KQoy
- They can search for the amount of water lost by sweating during sport activity
- How much water they drink during the sport activity
- If their activity needs a grass field (football field, etc.), they can calculate how much water is needed to grow the grass.

Phase 4: Share and present results

Out of class: After completing these steps, pupils should put together all the information gathered (photographs, data, calculations, drawings) about water and sport and make a poster on paper or in an online environment. They should prepare a one-minute talk containing the most interesting facts they learned within this activity about water consumption.

In class: Pupils present the results in class or online. In the next class, a short quiz focusing on interesting facts can be used for testing the memory and opening a final discussion.

Clean your water!

Goal of the activity *(Thanks to this activity, the students understood…)*	Pupils learn that water can be cleaned mechanically to remove basic impurities. They should realize through the construction of a water purifier how they can clean water by themselves with simple materials that can be found at their homes and in the nature.
Material	Internet connection, camera, plastic bottles, knife/scissors, coffee filter paper, spoon, filter material (sand, gravel and cotton or carbon), bottle of dirty water – 2 litres (full of sand, mud, plant residues, or other natural substances), laboratory report form
Time	**4 - 6 hours** (whole activity including preparation). Final duration depends on approach selected.
Form	**Individual/team project work** (collection of materials for water purification), **experiment and/or observation** how the water is purified step by step and reflect it with a text and photo description.

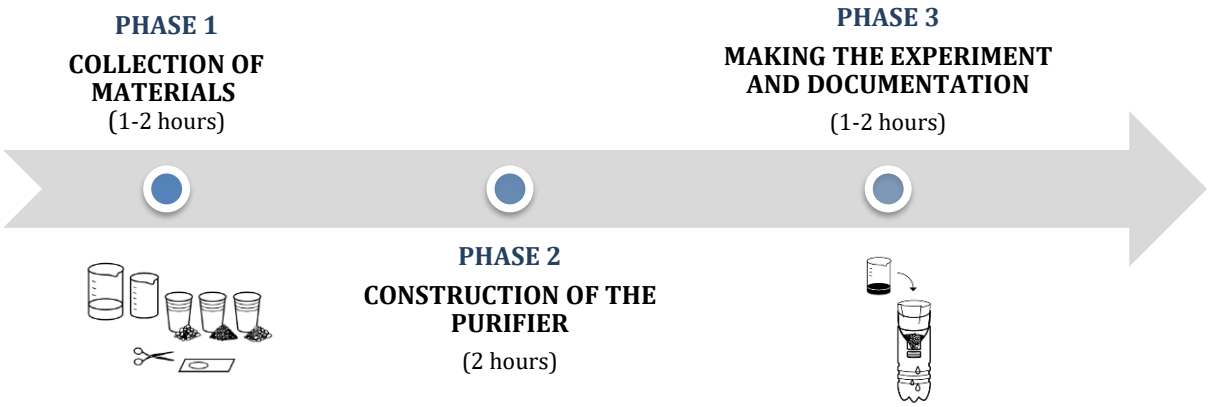
Introduction to the activity

The activity connects biology, chemistry and retention of water. Pupils should go outside and collect the materials needed to make the purifier (cotton, gravel, sand, etc.). Photo documentation of water changes: pupils should describe the experiment with photos as well as text, expressing their observations.

Phase 0: Activity preparation and introduction to pupils

In class (during online meeting): Introduce the whole activity. Explain the objectives – the nature of the activity – to the pupils. The introduction can be based on a story design: "Droughts occur all over the world and the amount of water decreases rapidly in certain periods of the year. People in many countries/areas have started to be afraid of not having enough water. The most difficult to decide is whether we should, e.g., water plants if we may not have enough water for humans. There is a solution. If you make a small invention and purify available grey water, this water will probably not be clean enough for you to drink, but it will be definitely clean enough for the plants. Thanks to your invention and experience, you will support plants and their roots will help keep water in the soil. Your invention may help a whole ecosystem survive."

Some time can be spent brainstorming and collecting knowledge, information and ideas about water cleaning. Pupils have the opportunity to contribute actively to the experiment – collect materials outside or bring them from home, try a simple experiment in the classroom or at home and document it properly.



Phase 1: Collection of materials

Out of class: Pupils should find and collect necessary materials mentioned before (plastic bottles, knife/scissors, coffee filter paper, spoon and filter material (sand, gravel and cotton or carbon)). It depends on the form of the experiment; if it is made at school by the teacher, the list of necessary material can be shared and each pupil is responsible for bringing only some of the items. If the experiment is made by pupils (whether at school or at home), each pupil needs all the items except the knife or scissors. Running the experiment at home is connected with the risk of staining the floor.

In class: The necessary materials coming from nature (e.g., sand and gravel) can be collected as part of another activity, e.g., school trip. The materials can also be collected by the teacher in advance. The purification process is presented briefly by the teacher before

making the experiment. There is a possible extension to the activity: to discuss the suitability of the materials used for filtration.

Phase 2: Construction of the purifier

In class/Out of class: Based on your preferences and the current pandemic situation, the experiment can be made at school by the teacher or the pupils, or at home by the pupils. The preparation process and the experiment itself can also be watched online. For the purposes of development of other skills (e.g., manual skills) it is recommended that the experiment is always carried out by pupils. The preparation of the purifier is very easy:

- Cut a plastic bottle in the middle to make a top half and a bottom half.
- Turnt the top of the bottle upside down and insert it into the lower half of the bottle to create a cylinder with a funnel.
- Put coffee filter paper into the bottle cylinder.
- Add gravel, sand, cotton/activated carbon onto the created filter.

Phase 3: Experiment and documentation

In class/Out of class: Now the apparatus for cleaning the water is ready. Pupils can add dirty water, which should contain mud, natural impurities, etc., to see the difference after the experiment. They should collect information about the process in the form of a photograph (before and after) to see the difference, describe the process and describe the impurities in the water or from where it was collected.

We recommend using a standard report format to document the purification process (date, place, initial state of dirty water, purifier description, final state, etc.). Photo documentation of water changes can be an integral part. The documentation process should be appropriate to the pupils' age and experience.

Calculate the virtual water footprint of a traditional meal

Goal of the activity *(Thanks to this activity, the students understood…)*	**The pupils should understand how much water their traditional meal costs.** They will count the virtual water footprint of each meal component and at the end, they will compare which traditional meal is more sustainable in terms of water consumption/savings. From this activity, pupils understand that each ingredient in their traditional (favourite) **food also needs water**, and they will realize how much water has been used.
Material	Recipe and ingredients for a traditional meal, calculator, paper or excel table, camera for documentation
Time	**Approximately 4-8 hours**
Form	**Individual work** (possible cooperation with parents, siblings or other family members such as grandparents). Pupils cook their traditional (favourite) food and count how many litres of water each ingredient added to the food needs.

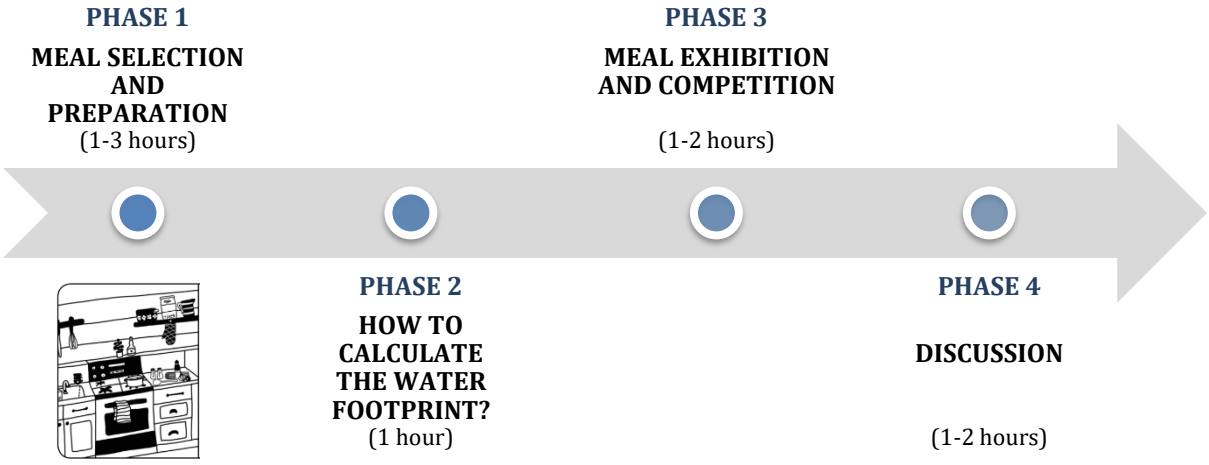
Introduction to the activity

Pupils prepare their favourite meal or a typical dish from a foreign cuisine and calculate how much it costs in terms of water. In this way, pupils can make a competition – which meal/meal from which country has the lowest water demand. Pupils can share the meal preparation process in the form of a poster (photo documentation, text description, drawings/paintings and water consumption calculations) or videos, etc. These posters or videos can then be uploaded to an online environment so that also other pupils can see the results.

Phase 0: Activity preparation and introduction to pupils

In class (during online meeting): The footprint concept should be introduced to pupils before the activity starts. It is important to justify what is behind the water footprint concept and why we should reflect the water footprint in our consumption behaviour. The introduction is easier if the carbon footprint concept has been presented and implemented in the past before this activity.

It is recommended to set some rules for the pupils to follow when selecting the meals they will prepare (e.g., to set a minimum and maximum preparation time, expenditure per serving of the meal, etc.).



Phase 1: Meal selection and preparation

Out of class: Each pupil chooses the traditional/favourite meal she/he wants to cook. After that, it is necessary to find the recipe, to assess whether it is within their ability to cook, and to check whether they can start preparing the meal straight away, or have to pick vegetables in the garden or go to the shop to buy the ingredients first. After all the ingredients are collected, the preparation can start. Support from parents or other adults is necessary for safety reasons.

Phase 2: How to calculate the water footprint?

Out of class/In class: After pupils chose the meal they want to cook/cooked, they can visit https://waterfootprint.org, where they can find examples of recipes and water footprints, or the teacher can give pupils our table (see Appendix 1), listing most important ingredients and their water footprints. Based on the table or the application, the total water footprint should be calculated by pupils. It is recommended to calculate the total footprint and then to consider the number of servings cooked and to recalculate the water footprint per serving.

Phase 3: Most sustainable meal exhibition and competition

Out of class: The water footprint calculation results are presented together with photos or videos of prepared meals. Other materials such as recipes or videos from the preparation can be placed as an appendix. All the results can be shared with other pupils and the teacher using either Book Creator and similar online tools (see previous activities) or via school cloud storage, e-twinning, etc.

In class: During a meeting of all the pupils and the teacher, all the prepared meals are presented using photos. At this stage, information about water footprint is hidden. After all the participants have seen all the meals, pupils use their own experience to try to estimate which meal will be the most water-intensive and which will require the least water, taking into account the water footprint concept. The water footprint information is now revealed. Pupils with the best guess may be rewarded (e.g., additional points to their overall rating in a subject).

In case the activity is implemented as part of a bilateral or international project (e.g., cooperation with foreign schools such as in the case of WatEdu), this activity can be taken as an international competition to motivate the pupils more. They can share their national results and calculate which country (or school) is more sustainable in terms of water consumption.

Phase 4: Discussion – How can you save a bit of water while cooking?

In class: After the competition results, there can be a discussion about the water footprint concept, how the pupils can upgrade the recipe in terms of water savings, etc. Its worth mentioning in the discussion that a lot of water and, e.g., air pollution can be saved and reduced by buying crops grown and processed in the country and, above all, by growing crops in your own garden, balcony, allotment garden or a community garden. By growing it yourself, you know the origin and quality.

Appendix 1: List of ingredients and their water footprint

Ingredient	Amount	Water footprint (L)*
Olive oil	Small bottle 100g	1400
Sugar	80 g	10
Flour	1 kg	1800
Eggs	4 eggs - 200 g	700
Milk	1 kg/l	1050
Yoghurt	200 g	200
Minced meat	400 g	6200
Bacon	400 g	1700
Meat	1 kg	10400
Sausage	400 g	2400
Rice	80 g	190
Baguette	400 g	600
Onions	200 g	50
Tomatoes	400 g	80
Carrots	1.5 kg	300
Potatoes	1 kg	300
Green beans	800 g	430
Spinach	1 kg	400
Lettuce	200 g	50
Cucumbers	400 g	140
Grated cheese	120 g	600
French fries	1 kg	580
Cheese	200 g	600
Spaghetti	400 g	740
Oranges	600 g	300
Chocolate pudding	500 g	550
Strawberries	500 g	180

Source: waterfootprint.org

* In addition to the water included in the water footprint associated with, for example, the cultivation of the crop or transport, it is necessary to include certain amount of so-called technical water used for e.g., washing of vegetables, cooking etc.