

'Water, water everywhere but not a drop to drink'* Investigating how to get clean water from dirty 'pond' water

About 72% of the Earth's surface is covered by water, most of it in the oceans. However, only 1% is usable by humans and land animals; obtaining clean water to drink is a problem in many countries of the world.

Can your pupils clean up dirty 'pond' water enough to be able to drink it and survive?

Ask the pupils:

- to obtain the cleanest water they can from the dirty 'pond' water they are given;
Because of health and safety problems associated with using pond water, it is best to make the dirty water using broken tea bags, colourings, powdered clay, grass and leaf debris etc. (If real pond water is used, ensure that all pupils wear plastic gloves.)
- in small groups, to plan how they will clean the dirty 'pond' water;
- plan the order they might need to do the various stages of cleaning, and what equipment they might need;
- provide the teacher with a list of requirements (they cannot add to this once they have decided). Less able pupils could be given some clues if they are struggling to decide;
- to clean their water using only the equipment requested. They have 20 minutes to get the best results they can.

At the end, the results are arranged in a row with group labels. Award points for the cleanliness of the water.

Then ask the pupils to give their conclusions. Is the cleaned pond water suitable for drinking?



Cleaning 'pond' water. Photo: Peter Kennett

The back up:

Title: 'Water, water everywhere, but not a drop to drink'*

*'Water, water everywhere nor any drop to drink' is a quote from 'The Rime of the Ancient Mariner' by Samuel Taylor Coleridge, 1797-98

Subtitle: Investigating how to get clean water from dirty 'pond' water

Topic:

This activity could be used in any lessons involving water supply. People have always needed to find clean water to drink. It is a vital factor in where people can live.

Age range of pupils: 10 - 16 years

Time needed to complete activity: 45 minutes

Pupil learning outcomes: Pupils can:

- plan, carry out and evaluate a complete investigation;

- work out the necessary equipment to carry out their investigation;
- clean dirty pond water by filtering through a filter and/or sand;
- realise that cleaned pond water needs further processing before it is suitable to drink;
- suggest the further treatment that might be necessary.

Context:

- Pupils usually decide to sieve the pond water first using sieves or nets to remove floating material. Ask them to keep a list of what is removed.
- They usually filter the pond water using filter paper next.
- Some may then wish to filter the water through sand.
- In their conclusions, the pupils should say that the cleaned pond water is still NOT suitable for drinking. It has not been tested for its contents and would need to be cleaned more thoroughly to remove soluble contaminants and bacteria.

At the end of the investigation, pupils should know that dirty pond water may contain:

- suspended solids, like plant debris, rubbish and mud;
- soluble contaminants (cannot be removed in the classroom);
- invisibles, e.g. bacteria – point out that real pond water would contain bacteria.

If it is suitable for your pupils, you might then discuss how the bacteria might be removed.

Possibilities include:

- distillation;
- adding chemicals, such as water sterilisation tablets or chlorine (as is done commercially);
- using ultra-violet light.

Explain that our drinking water is filtered carefully to make it safe to drink. Water that filters down through rocks like sandstone, is often very good quality drinking water. Water can also be cleaned by using charcoal and, in the past, straw.

Following up the activity:

- Try making and testing filters using charcoal and straw, laid in layers in a flower pot;
- Visit a local water-cleaning facility; many have Visitor Centres;
- Look at the origins of bottled water on the labels on the bottles;
- The pupils could investigate further how their cleaned pond water could be turned into drinking water;
- Investigate how sea water can be turned into fresh drinking water in desalination plants.

Underlying principles:

- Water has to be filtered or treated to make it safe to drink.
- Water that filters through rock is usually good quality drinking water.
- Pond water (real or made up) contains suspended solids, soluble contaminants and invisibles, e.g. bacteria.
- Only 1% of Earth's water is usable for humans and land animals.

- One-fifth of the world's population does not have access to sufficient clean drinking water.
- Polluted drinking water is the chief cause of disease around the world.

Thinking skill development:

- Carrying out the stages of the investigation involves identifying a pattern.
- Trial and error in cleaning the water creates cognitive conflict.
- Discussion about the investigation is metacognition
- Applying the cleaning of the 'pond' water to commercial cleaning of water for people to drink is bridging.

Resource list:

For each group:

- 2 x 1 litre containers – to hold the 'before' and 'after' 'pond' water for each group
- 1 funnel (cut-off tops of bottles can be used)
- filter paper
- muslin or fine-mesh cloth
- washed sand
- absorbent cloths
- sieve
- pond-dipping net
- a variety of other plastic containers.

One only:

- bucket for dirty pond water
- broken tea bags, colourings, grass and leaf debris
- powdered clay (made by letting clay dry and then crushing or filing it).

Useful links:

Earthlearningidea - Water cycle 'thought experiment' 'Space survival: how we could survive a year in a dome'

www.earthlearningidea.com/English/Earth_as_a_System.html

[www.primaryschool.com.au/environmentresults.php?strand=Water Quality and Management&grade=56](http://www.primaryschool.com.au/environmentresults.php?strand=Water%20Quality%20and%20Management&grade=56)

Source:

ESEU Primary Earth Science Workshops 'How the Earth Works in Your Classroom', from a wide variety of sources, collated by Niki Whitburn.

<http://www.earthscienceeducation.com>

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