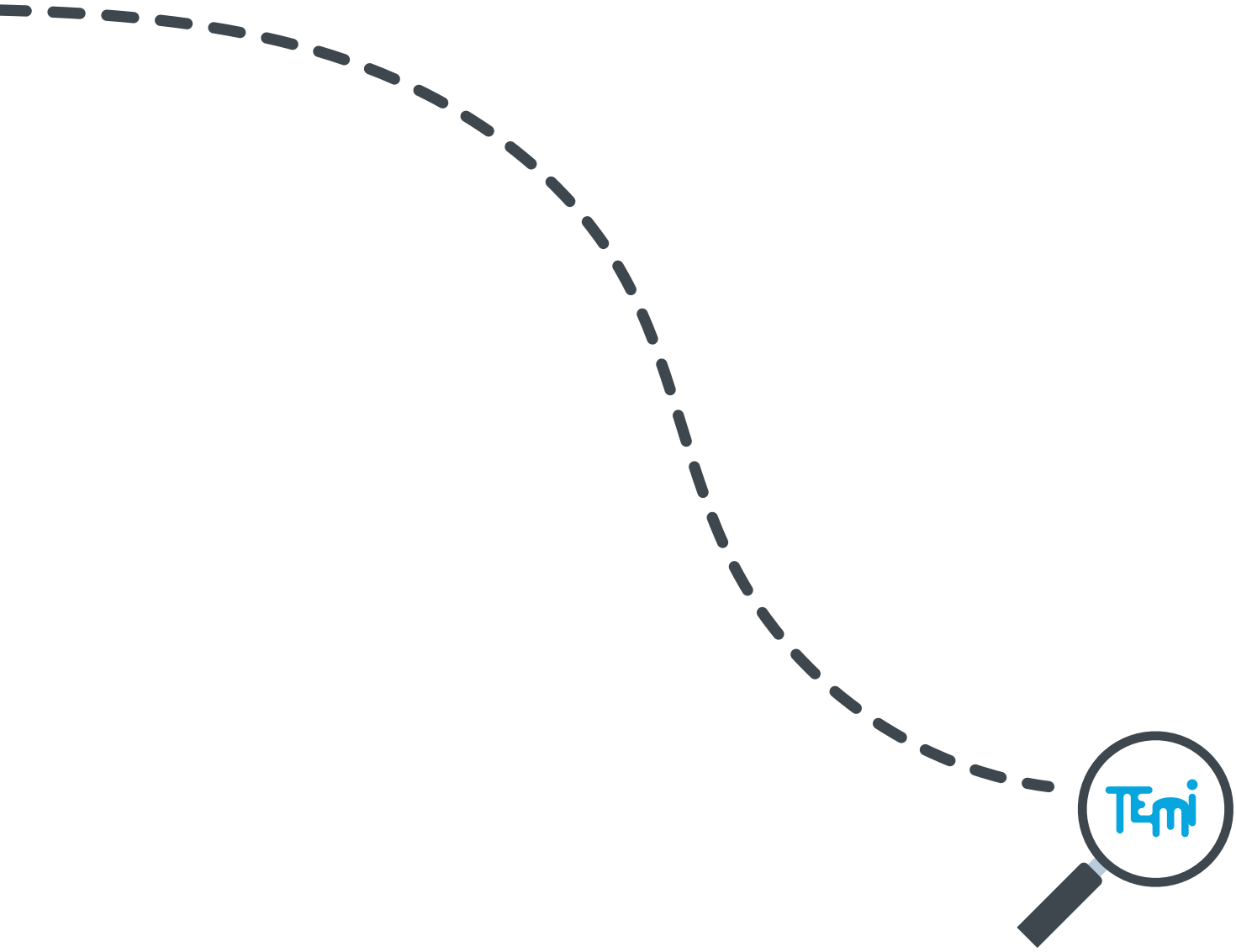
Red or blue flowers?

CLASSROOM SCIENCE ACTIVITY TO
SUPPORT STUDENT ENQUIRY-BASED LEARNING



This classroom-tested teaching plan uses the four innovations of the TEMI project, as detailed in the Teaching the TEMI Way (TEMI, 2015).

You should read this companion book to get the most from your teaching. The **TEMI** techniques used in this teaching plan are: **1)** productive science mysteries, **2)** the **5E model** for engaged learning, **3)** the use of presentation skills to engage your students, and **4)** the apprenticeship model for learning through gradual release of responsibility. You might also wish to use the hypothesiser lifeline sheet (available on the **TEMI** website) to help your students document their ideas and discoveries as they work.

To know more about **TEMI** and find more resources **www.teachingmysteries.eu**

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teachingmysteries.eu

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Red or blue flowers?

What's the mystery?

The teacher couldn't decide whether to wear a red flower or a blue one, so they decided on a compromise: a half red, half blue flower! But something like that can't be natural, can it?

DOMAIN(S)

Biology.

SUBDOMAIN KEYWORDS

Water in plants, water transport in plants, capillary action, osmosis.

AGE GROUP

14 to **16** years old.

EXPECTED TIME FOR THE MYSTERY

Approximate time for teacher preparation:
40 min.

Approximate time in classroom:
two 45 min. lessons.

SAFETY/SUPERVISION

No restrictions needed.

Disclaimer: the authors of this teaching material will not be held responsible for any injury or damage to persons or properties that might occur in its use.

PREPARATION AND LIST OF MATERIALS

- White flowers (works best with carnations)
- Coloured ink
- Glasses/beakers
- Various materials the students can use for their experiments (see the teacher materials).

LEARNING OBJECTIVES

Physiology of plants, anatomy of plants, cell biology, osmosis, diffusion, capillary action.

Guidance notes for teachers

Engage

CAPTURE STUDENTS' ATTENTION

The teacher shows the students a flower that is half one colour and half another (prepared beforehand*) and asks them how this can be so. The teacher also tells a story about overhearing two boys talking about how the flower could have been created. They were discussing the drinking regime of plants when one of them said that he heard that a tree can bring 500 litres of water from the ground to its topmost branches. The boys wonder how this occurs. The class is invited to consider what this has to do with the strange flower.

*** Split a flower's stem in half (works best with carnations) and put each half of the stem into coloured water. The colour of the blossom should be split after a day or two.**

Explore

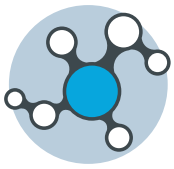
COLLECT DATA FROM EXPERIMENTS

The students are asked to think up their own experiment that might demonstrate the transportation of water in plants. The students can use the Internet or available literature for research, or discuss the matter with the teacher. This task can also be used as homework. In-class colouring of plants works best with pieces of celery about 1–2 cm wide. Put them in a thin layer of coloured water and watch the liquid rise in about 15 minutes.

Explain

WHAT'S THE SCIENCE BEHIND THE MYSTERY?

The two main processes for water transportation in plants are diffusion and osmosis. Water moves through vascular bundles and its transport relates mostly to its physical properties. Water mostly transports minerals from the soil (in our case, the colouring).



Extend

WHAT OTHER RELATED AREAS CAN BE EXPLORED?

A discussion about similar processes in everyday life: capillary action in walls, clothing, the absorbency of paper towels, etc. A microscopic observation of appropriately stained and prepared vascular bundles is also possible. How many times can the stem be split? What about 'rainbow roses'?

Evaluate

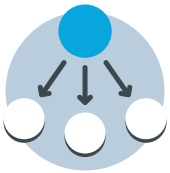
CHECK THE LEVEL OF STUDENT SCIENTIFIC UNDERSTANDING

The students' experiments are evaluated by other students through peer review and by the teacher through a guided discussion.

Showmanship

TIPS ON HOW TO TEACH AND PRESENT THIS MYSTERY

The teacher tells a story of how he or she couldn't decide whether to wear a red or blue flower in his lapel to a formal event, so they decided to have a flower with both of these colors at once. The teacher then demonstrates the bi-colored flower and asks the students how is it possible.



GRR

TEACHING SKILLS USING GRADUAL RELEASE OF RESPONSIBILITY

Setting up the mystery: the teacher shows the class the double-coloured flower.

Demonstrated enquiry (level 0): the teacher asks how it is possible and then shows the class the inside of an opaque vase. The flower's stem was cut in half and each half was placed in a vial containing coloured ink. The teacher explains their hypothesis: that the flower somehow 'drank' the colour using the 'straws' in its stem. Students record this thought on their hypothesiser lifeline worksheet.

Structured enquiry (level 1): students then use their hypothesiser lifeline sheet to record their own alternative ideas about how the flower transports water and to record their tests and conclusions regarding these other explanations.

Solving the mystery: students are led towards the explanation of the mystery using ideas about water transport in plants and evaporation as a driving force to pull water upwards from the roots.

Resources

The colouration process takes a long time. You can watch it sped up with two white roses on the TEMI Youtube Channel:

www.goo.gl/tUDaq5
playlist > Colored flower

You can see the split colouration of a carnation on the TEMI Youtube Channel:

www.goo.gl/tUDaq5
playlist > Colored changing carnation

Red or blue flowers?

STUDENT WORKSHEET

The teacher couldn't decide whether to wear a red flower or a blue one, so they decided on a compromise! But something like that cannot be natural, can it?

Engage

WHAT'S INTERESTING?

Task: The teacher has an unusual flower to show: each half is a different colour. How can this happen?

Explore

WHAT'S HAPPENING?

Task 1: How do you colour a flower? How do you make it two different colours? It's all just one part of a greater mystery. If water always runs downhill, then how does it get UP into flowers?

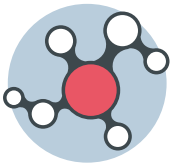
Task 2: Even if water can get into flowers, what about big trees? How can they be strong enough to pull water up tens of metres?

Explain

WHAT'S CAUSING IT?

Task 1: You have learnt about diffusion and osmosis. Explain what these processes are and how they keep the plants hydrated.

Task 2: Mix the two coloured inks together. Why does the flower keep the separate colours instead of blending them?



Extend

WHAT'S SIMILAR?

Task: Lots of objects in everyday life have the same ability to 'pull' water as plants. Try experimenting with various materials. What do the ones that 'work' have in common?

Evaluate

WHAT'S MY UNDERSTANDING?

Task 1: Could you produce a flower with more than two colours? What would happen if you tried this process on a coloured flower instead of a white one? Could you produce a fabled blue rose?

Task 2: What did you learn about your clothes? Which fabric would be better in summer: one that 'pulls' water in or one that doesn't?