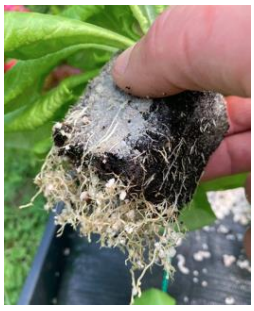
ACTIVITY DOSE PROJECT '22 –

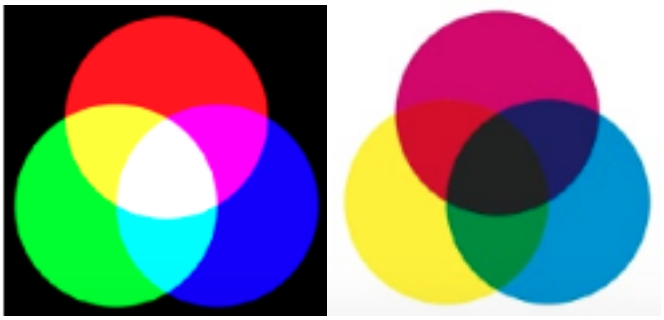
Author: Marijke Lippens
School: Sint-Idesbald, De Zilten 52, Roeselare, Belgium

Title Activity	Upgrading the school garden
Age	☒ **3rd grade primary school (10-12 yo)** ☒ **1st grade High School (12- 14 yo)** ☒ **Higher grades (14+ yo)**
Estimated duration	4 x 50' (spread over 2-3 weeks)
learning objectives / competences	(The pupils can ...) - The pupils investigate what plants need in order to grow. - The pupils design a QR code for each type of plant. - The pupils design a micro garden without soil on hydroculture. - Automate the process of illumination and feeding. - The pupils record the data of the plants in a graph.
Short description of the activity (max. 4 sentences)	
No space to have a garden of your own? You want to grow your own herbs at home even during winter all-year round? You can plant herbs in pots and then wait… but even then there's no guarantee on success. You still need to have soil and water them every now and then. Is there no better (automated and clean) solution?	

CONTEXT	
Motivation	This activity focuses on the importance of water. - Water as a means of transporting nutrients - One of the problems in the preparatory activities was a scarcity of drinking water. If you compare growing crops in hydro-culture to growing in soil, less water is used growing in hydro-culture. Important research skills: Setting up, changing only 1 variable each time, reporting. In a second stage we investigate what colours of the light spectrum and therefore what kind of artificial light is needed to let plants grow when they lack the sunlight provided in open-air conditions.

Where is the STE(A)M integration? (in a few words, small checklist for yourself)	**S: investigating under what conditions plants grow, comparing them with open-air conditions and soil.** **T: set up a test rig with plants, hydroculture, artificial light.** **E: enhance growth by using the right parameters** **(A:) designing an inside garden, prototyping (both functional and aesthetic.** **M: convert growing conditions data into a graph**
Methodology and required materials	
Materials	Per class: ● Seedlings, container with Perlite, water, Wuxal fertilizer ● Test field if possible (control group) ● Electricity ● Measuring cup ● Preferably transparent curverbucket ● Microcontroller for lighting control or time swith (socket 220 V) ● Perlite  Per group: specific local requirements: - a vegetable garden at school as control group - rack to put plants on where conditions can be controlled.
Coaching & methodology (your 'lesson preparation') Are you paying attention to the research questions you are going to ask? Do you let your pupils investigate on their own?	
Timing: 10' Work format and classroom organisation: Classroom	**Preface:** To start with, we build a rack in the classroom. On that we put breeding boxes for plants. The breeding boxes have a hole in the bottom to let water flow away (as plants cannot have their roots constantly in the water) or lead water to the next breeding box.

Timing: dedicated moments during several days Method and class organisation: whole class. When enough material is available, more test setups can be made.	Note: Contrary to what is shown on the photo, we cannot use soil. Either the seedlings are in water or in perlite.    **Part 1: Investigations: water as a means of transporting nutrients.** Brainstorm in the classroom: How do plants grow? What do plants need? (light, nutrients). The light we tackle in the next stage. Research: What do plants need to grow? The students should come to the next setup: two breeding boxes are getting distilled, pure water. Two other breeding boxes receive water with a plant nutrient. A few days into the investigation, we come to the conclusion that plants need nutrients and that they are transported with water. Irrigation of the plants can be automated. We need a small water pump (used in fish tanks or campers) and a way to control the pump so it irrigates 6 times/24 hours. We can use a timer or a micro-controller (such as Micro-Bit). **Part 2: artificial light** Next to nutrients, plants need light.

Timing: dedicated moments during several days Method and class organisation: classroom and groups	To be exact: 18 hours per day (refer to photosynthesis) Inside there is no direct sunlight. What can replace the sunlight in order to grow? (TL, LED, classic light bulb, …) Use the previous rack with plants as a test-setup to investigate light conditions. Extra Tip: the light spectrum is made up of three basic colours (visible to the human eye): red, green, blue. Contrary to mixing paint, colors don't mix up the same in the light spectrum.  Plants reflect green, so they will benefit the most of red and blue. **Part 3: Analysing** In 2 weeks time (depending on the type of plant) the children often see the artificial environment that is used as breeding setum for the plants. Data such as weight and growth under specific circumstances can be retrieved and processed in graphs. What are the better growing conditions for plants inside? If necessary, adjustments are made. **Part 4: Reflecting** We let another class visit the vegetable garden. The children make pairs so that the classes are mixed. They take a tablet and scan the QR codes. They look at the data online about the different types of plants. They evaluate the visit together on the basis of the following questions: - What are the best conditions for growing plants inside?
Timing: dedicated moments during several days Method and class organisation: classroom and groups	

Timing: 15' Work format and classroom organisation: Classroom	**Reflection (on both cooperation and the product):** In a class discussion we discuss the entire activity 'upgrading the school garden'. The following questions are addressed: - What have we investigated, and how does photosynthesis work? - Do our plants grow under artificial circumstances? - What did we design? And how did it go? - Is the data clear? - Can you convert the data into graphs? - How was the cooperation? - What have you learned? - Are you satisfied with the end result? - How can we upscale our inside garden?  Fact or fake?

How do you evaluate the acquired competences of the pupils during this activity? (e.g. specific questions, extended instruction, differentiation,...)

Is there an evaluation after the activity to record the acquired knowledge/skills?

During a wero test, the knowledge about plants, how plants grow, can be tested.

During the execution of the task, the teacher can observe the children's skills.

During a maths lesson, the data can be converted into graphs.

Tips & tricks

(which would you give to another teacher to make that lesson go more smoothly)

- Make a time-lapse of the growth of the plants. With a tablet pointed to the test ground you can automatically take a picture every two hours. A simple app then produces a 'video' (time-lapse)

Additional information / Links:

https://www.youtube.com/watch?v=3V3mkQXAqDs

Contact person: kristof.vandekeere@vives.be, geert.neyrynck@vives.be