

# Classroom Aquaponics

<b>Date:</b>		<b>Subject:</b>	Science
<b>Grade Level:</b>	PreK-2		
<b>Lesson Title:</b>	Soil and Sustainable Aquaponics		
<b>Standard(s):</b>	<b>AG Standard: T1.K-2.a</b> Describe how farmers/ranchers use land to grow crops and support livestock <b>Clarification Statement:</b> Instead of land, students will describe how and why we would choose to grow plants in water.		
<b>NGSS:</b>	<b>2-LS2-1.</b> Plan and conduct an investigation to determine if plants need sunlight and water to grow <b>Crosscutting Concept:</b> Events have causes that generate observable patterns		
<b>Objective (cognitive):</b>	After building an aquaponics apparatus, students will be able to write three sentences about the importance of sustainability.		
<b>Objective (affective):</b>	After building the aquaponics apparatus, students will be able to write two sentences on whether they think the little prince would like aquaponics.		
<b>Objective (psychomotor):</b>	After talking about agriculture space, students will be able to set up aquaponics apparatuses with teacher instruction.		

## Book(s) or Supported Reading(s):

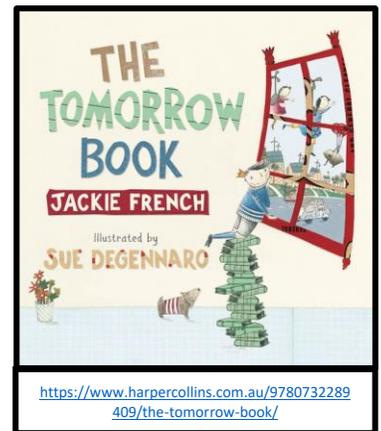
*The Tomorrow Book* by Jackie French (2010)

## Materials & Supplies LISTED:

- *The Tomorrow Book*
- Knife
- Apple
- Paper Towel

## Aquaponics Apparatus (enough for 2 apparatuses)

- 2 Mason jars (Can be substituted with the bottom half of a 2-liter soda bottle)
- Fish tank gravel/ rocks
- 2 Betta fish (or other aquatic animal; see resources for which animal works best for you)
- Fish food
- 2 net pots (Can be substituted with Plastic cups, with slits cut in them)
- 2 Live plant/ seeds (see resources for which plant works best for you)



<https://www.harpercollins.com.au/9780732289409/the-tomorrow-book/>

## Anticipatory Set/ Enticement (Pre-reading & Prerequisite Skills): (5-10 minutes)

Read *The Tomorrow Book* by Jackie French out loud with the students. Ask prompting questions when necessary. Examples include:

- a. *Page 4:* What does the world look like? What do you think the prince was imagining when he read? Does this world look good? Why or why not?
- b. *Page 11:* What did the little prince suggest the kids do? How does it work? Why do you think it works so well? Does this look different than the world we saw before? How so?
- c. *Page 13:* What is petrol? What's another word for it? How do we use it? Where does it come from?
- d. *Page 15:* Do we use the sun or the wind for power? Where have you seen it? Why do we use the sun or wind? How is it better for the Earth? Can you really fly around with balloons?

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e. *End page*: What do you think the main idea of this book is? Do you know what the term “sustainability” means? (If not explain). How did the little prince pick more sustainable choices?

**Modeling/ Explanation** (I can): (7-15 minutes)

**Take an apple out of a bag or drawer.** Tell students that this apple represents our planet. How much of this apple do they think we can grow food on? *Give time for students to make predictions.*

Well, there’s a big part of the world that we don’t use to grow plants and food. Do you know what it is? **Cut the apple into quarters. Hold out  $\frac{3}{4}$  in one hand.** What do these  $\frac{3}{4}$  represent? *Lead students to answer “Water” or “oceans”.*

**Set the three “water” sections aside and hold out the remaining quarter.** What fraction of the apple remain? *Lead students to the answer “1/4”* This  $\frac{1}{4}$  represents the total land surface of our planet. Is that as much as you were thinking?

**Slice the remaining  $\frac{1}{4}$  in half, lengthwise. Hold out one of the pieces.** What fraction of the apple is this?  $\frac{1}{8}$  This  $\frac{1}{8}$  represents the half of Earth’s surface that is inhospitable to people and to crops. Can you think of anywhere this may be? *The polar regions, deserts, swamps, and high or rocky mountains.*

**Set that  $\frac{1}{8}$  aside and hold out the other.** This  $\frac{1}{8}$  represents the other half of the Earth’s surface. These are the places where people can live, but cannot necessarily grow food.

**Slice  $\frac{1}{8}$  crosswise into four equal pieces. Hold out  $\frac{3}{32}$  in one hand.** These  $\frac{3}{32}$  represent land on which people can live but cannot grow food. Why do you think people can’t grow food here? *Give time answers.* Some of these areas used to be able to grow food but now they’re developed. This means that we’ve turned these areas into cities, highways, towns, and other things. This also includes places that the government has set aside like national parks and nature reserves that should never be developed.

**Set these  $\frac{3}{32}$  aside and hold out  $\frac{1}{32}$ .** So, only  $\frac{1}{32}$  of the Earth’s surface has the potential to grow the food needed for the all the people of the Earth. But do we really get to use all of this? *Give time for ideas and answers.*

**Peel the  $\frac{1}{32}$  slice of Earth. Hold up the peel.** This tiny little bit of peel represents the top soil, the dark, nutrient-rich soil that hold moisture and feeds us by feeding our crops.

Where was the place in which we lost the most amount of Apple, or the planet? *Guide students to answer the water.* Exactly, we have a lot of water in the oceans don’t we? Wouldn’t it be cool if we could use the water to do what the little prince did in our book, and make sustainable choices?

**Guided Practice/ Engagement & Exploration** (We can): (15-20 minutes)

Ask students if they think we could grow plants in just water? Groups students up or have them partner up and write down what a plant needs to grow. After about 2-3 minutes, let students share and write down their answers on the board. Answers should include sunlight, water, oxygen, carbon dioxide, and nutrients. These answers may vary based on the age group.

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(Possible Misconception: Students may still think that plants need soil to live. Explicitly tell them that the plants do not need the soil, they only need the nutrients in the soil. This is why we do not include soil on our list.)

Ask students if they think there's any way that we could provide all of these things for the plant without the soil. Give time for answers. Tell students that we will be creating a design today where plants can grow in water.

Get out the materials for the mason jar aquaponics. You can purchase these individually or buy specific kits. Kits range at a higher price though, so all of these materials can be purchased separately to save money. There is a resource list at the end of the lesson for help in choosing materials for your aquaponics lesson and the proper upkeep for your apparatus.

Divide the class in half. Each half will be in charge of setting up one apparatus. Have students wash out the mason jar and the wash off the gravel. Place the fish gravel into the mason jar. Have students add distilled water to the jar and then add one Betta fish to each jar.

Next, add gravel to the pot and add your plant. Then set the pot into the jar. The water level in the jar should be reach a little bit above the bottom of your pot.

If you are using plastic cups, help students cut slits/ holes into them. Ask students why we have slits/ holes in the pot? *This allows water and air to pass through to the plant roots.*

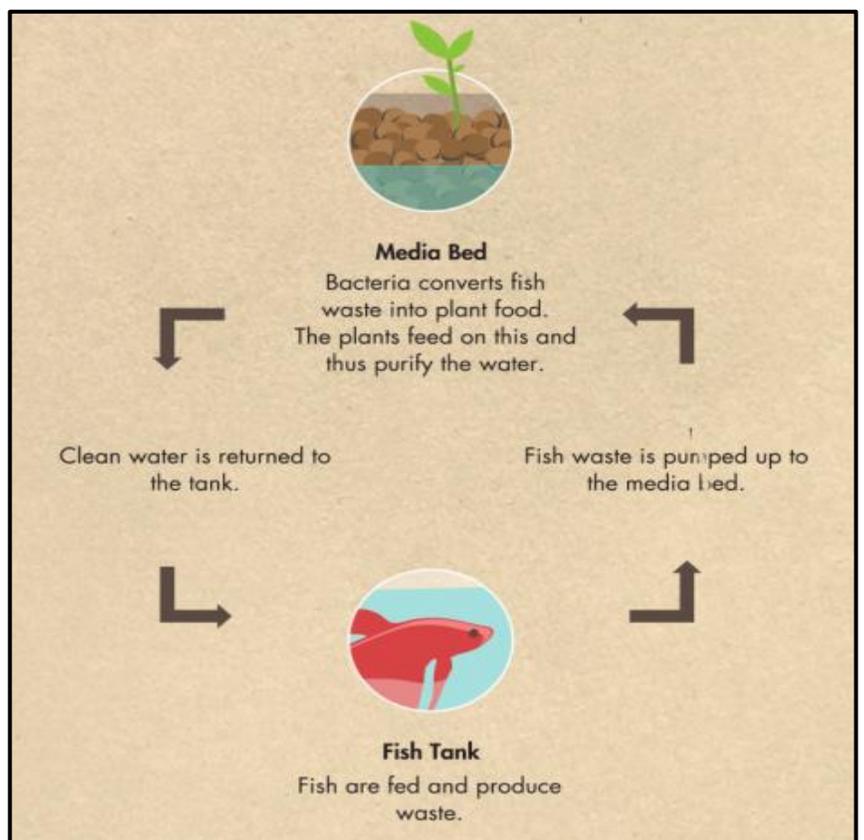
Refer back to your list of what the plants need to grow. Ask if the plants have water. Yes. Do they have air? Yes. Do they have sunlight? Yes. What about nutrients? Show

students the attached image from <https://www.desima.co/blog/2016/3/2/aquaponics-hydroponics> that is labeled how does it work. Explain to students that the fish will produce waste that is converted by bacteria and used by the plants as nutrients. This will help the plant to grow, even though it doesn't have soil. Then, the plant will purify the water for the fish to live in it. So the fish and the plant will live together.

**Independent Practice/ Elaboration** (You can): (5-10 minutes)

Now, tell students that we will have one plant in the sunlight and one plant in another part of the room.

Set the aquaponics systems up in these places.



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Group students into small groups and have them discuss which one they think will grow better, the one in sunlight or the one without sunlight. Why? How is this a more sustainable choice than growing crops in soil? Do you think the little prince in our story would approve?

## **Closure:** (5-10 minutes)

As closure, explain to students that we will be having a new job in the room. Along with the rotations for other jobs in the room (like paper passer or line leader) we will also have a fish feeder and two students who write down observations about what each plant is doing. These “Observationalists” will share their observations with the class during group time.

## **Assessment/ Evaluation**

*Lower Grades/ **Summative; Informal:*** Have a review discussion in which each student talks about their feelings about sustainability. How does the aquaponics system work? Do you think it will help people grow food? Why is sustainability important? Which plant will grow better: the one with or without sunlight?

*Higher grades/ **Summative; Formal:*** Have students write 3 sentences about the importance of sustainability and 2 sentences about whether they think the little prince would be proud of the aquaponics system. Why or why not? **(5 Points)** Give 3 point for the sustainability answer and 2 points for the little prince answer.

## **Enrichment/ Extension**

The students can write down their predictions about which plant will grow better, the one with or without sunlight, and at the end of a few weeks, come back to the prediction. We can review the predictions and whether or not they were right and if their thinking has changed at all.

## **Modification/ Differentiation:**

*Modeling:* If needed, you can shorten the modeling portion by cutting the apple up into fourths and then focusing on the  $\frac{3}{4}$  part that represents the water instead of cutting the rest of the apple.

*RTI:* Spend more time on how the aquaponics system works, focusing on how the plant gets nutrients from the fish which lets the plant grow. The plant then purifies the water which helps the fish to grow. This is sustainable because the plant and the fish can live together and grow and provide food for us without hurting the water.

*TAG:* Instead of choosing all of the materials yourself, you can introduce the topic earlier and then do research with the students as to which plant, jar, and fish would be best. This involves them in the research process and they will have accountability for apparatuses.

## **Resources to Use:**

<https://www.desima.co/blog/2016/3/2/aquaponics-hydroponics>

<https://thelifeaquaponic.wordpress.com/2015/07/14/mason-jar-aquaponics/>