Sustainability Science Sleuths

Day 6

DiscoveryCube

This guide accompanies *Sustainability Science Sleuths Day 6*

PRIOR TO TEACHING

Subject

Water Conservation

Program Length

45 minutes – 1 hour

Program Objective

Discover the hidden ways you use water every day and learn how you can make choices to reduce your water use. Then, be inspired by our custom water footprint calculator and learn how to talk to a computer by creating your own code.

Next Generation Science Standards

3-LS3-2: Use evidence to support the explanation that traits can be influenced by the environment.

3-LS4-3: Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.

3-LS4-4: Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.

5-ESS2-1: Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.

5-ESS3-1: Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

3-5-ETS1-2: Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

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Computer Science Standards

3-5.AP.11: Create programs that use variables to store and modify data.

3-5.AP.12: Create programs that include events, loops, and conditionals.

3-5.AP.13: Decompose problems into smaller, manageable tasks which may themselves be decomposed.

3-5.AP.17: Test and debug a program or algorithm to ensure it accomplishes the intended task.

What I Need Today

SUPPLIED BY TEACHER/STUDENTS:

- ☐ t-shirt
- ☐ paper
- ☐ pen or pencil
- ☐ computers or tablets with access to the internet (if it's possible, have your students use two devices for these activities)

Vocabulary

Water Footprint – The amount of freshwater used by a person, both directly (such as to shower or drink) and indirectly.

Indirect Water Footprint – The amount of freshwater used to produce goods and services a person needs or enjoys (such as making and transporting clothes, food, or gasoline).

Code – A set of commands or instructions, usually intended for a computer.

Computer Programming – A group of written instructions that makes a computer do something.

Programming Blocks – Puzzle pieces of text that can easily be dragged and dropped, rearranged, and snapped together to create code. Each "block" contains text "under the hood" that tells the computer what to do.

Script – The written text of coding. In Scratch, the Script Window is where the blocks of code are assembled.

Sprite – A character in Scratch that can be programmed to do a variety of tasks.

Sequence – A set of instructions, given in a specific order, that helps the computer complete a task.

Command – An instruction.

Stage – The name for a background or backdrop used in Scratch.

Snap – What happens when two or more blocks of code are attached.

Costume – The name for different images of the Sprite in Scratch.

Loop – A sequence of code that repeats.

Instructor Prep

- ☐ This day includes a coding activity. If you do not feel comfortable teaching coding, we have included another activity option: My T-Shirt's Water Story.

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PROCEDURE

What We'll Learn

We all use water every day to drink, cook, and clean, but it's also used to make the clothes we wear, the food we eat, and the gas we use to power our cars.

What Will Happen?

Scientists ask questions and make predictions before they start investigating. Have your students hypothesize: where do I use the most water?

- ○ In the bathroom
- ○ In the kitchen
- ○ In my yard, garden, or green space
- ○ In my bedroom
- ○ In my closet

What to Do

REVIEW - DAY 5: GROUNDWATER

Last time you met, you learned about underground water storage systems called aquifers. Even though aquifers can store a lot of water underground, they don't have an infinite supply, so it's important for us to conserve, or save, water.

VIDEO - WAYS TO SAVE

To start learning about water conservation, first watch *Ways to Save*: https://vimeo.com/489689187/a68e9f56f7

Reflect on the video: what did your students learn?

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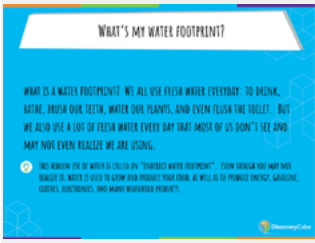
ACTIVITY - WHAT'S MY WATER FOOTPRINT?



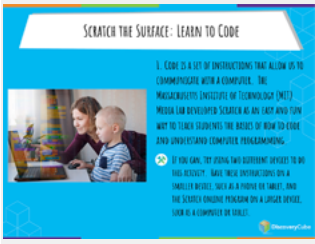
1) We all have a water footprint, but if you lift your foot, you won't see a pool of water in the shape of your foot. So what is a water footprint? We all use fresh water everyday: to drink, bathe, brush our teeth, water our plants, and even flush the toilet. But we also use a lot of fresh water every day that most of us don't see and may not even realize we are using.

Fun Fact: This hidden use of water is called an "indirect water footprint". Even though you may not realize it, water is used to grow and produce your food, as well as to produce energy, gasoline, clothes, electronics, and many household products.

2) To find your water footprint, visit:
https://scratch.mit.edu/projects/457472357/fullscreen/
Select the choices that best reflect your activities and behaviors and watch your water footprint grow. Then, try choosing other choices to see if you can lower your water footprint. Can you turn these new behaviors into healthy habits?

Fun Fact: We made this water footprint calculator using Scratch. You, too, can learn to code on Scratch. Our step-by-step instructions make it simple for anyone to learn to code using Scratch. If, however, you still do not feel comfortable teaching coding, you can jump ahead to the optional My T-Shirt's Water Story activity.

OPTIONAL ACTIVITY - SCRATCH THE SURFACE: LEARN TO CODE



1) Code is a set of instructions that allow us to communicate with a computer. The Massachusetts Institute of Technology (MIT) Media Lab developed Scratch as an easy and fun way to teach students the basics of how to code and understand computer programming. To start coding, visit *https://scratch.mit.edu/projects/editor/*.

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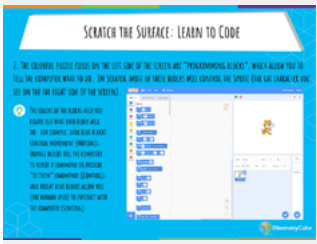
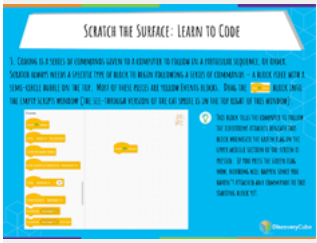
2) The colorful puzzle pieces on the left side of the screen are "programming blocks", which allow you to tell the computer what to do. In Scratch, most of these blocks will control the Sprite (the cat character you see on the far right side of the screen).



Fun Fact: The colors of the blocks help you figure out what each block will do. For example, dark blue blocks control movement (Motion); orange blocks tell the computer to repeat a command or provide "if/then" commands (Control); and bright blue blocks allow you (the human user) to interact with the computer (Sensing).

3) Coding is a series of commands given to a computer to follow in a particular sequence, or order. Scratch always needs a specific type of block to begin following a series of commands – a block piece with a semi-circle bubble on the top. Most of these pieces are yellow Events blocks. Drag the 

block into the empty scripts window (the see-through version of the cat sprite is in the top right of this window).



Fun Fact: This block tells the computer to follow the directions attached beneath this block whenever the green flag in the upper middle section of the screen is pressed. If you press the green flag now, nothing will happen since you haven't attached any commands to this starting block yet.

4) Let's get our cat sprite to move forward 10 steps on the stage. To do this, drag the dark blue 

block until it "snaps" like a puzzle piece to the bottom of your starting block in the scripts window. Now press the green flag and watch as the computer follows your command!

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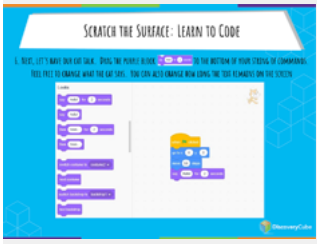
5) If you want the cat to move forward more or fewer spaces, type a larger or smaller number into the white circle of this block. Press the green flag again to get the cat to move.

Tips & Tricks: Did you notice that the cat never moves back to his starting position? That's because you haven't told the computer to move the cat back to the starting position. To do that, drag the dark blue 

block in-between the starting block and the move forward block. Then set the x and y coordinates so they both are zero (0).

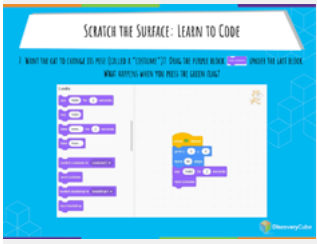
6) Next, let's have our cat talk. Drag the purple 

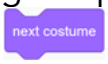
block to the bottom of your string of commands. Feel free to change what the cat says. You can also change how long the text remains on the screen.



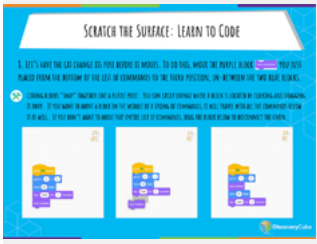
7) Want the cat to change its pose (called a "costume")? Drag the purple 

block under the last block. What happens when you press the green flag?



8) Let's have the cat change its pose *before* it moves. To do this, move the purple 

block you just placed from the bottom of the list of commands to the third position, in-between the two blue blocks.



Tips & Tricks: Coding blocks "snap" together like a puzzle piece. You can easily change where a block is located by clicking and dragging it away. If you want to move a block in the middle of a string of commands, it will travel with all the commands below it as well. If you don't want to move that entire list of commands, drag the block below to disconnect the chain.

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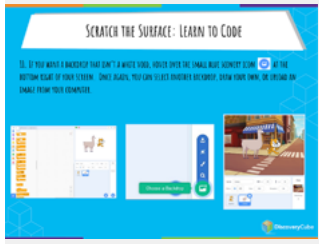
9) Now let's have the cat move forward 100 steps, while changing costumes every 10 steps. You could drag a whole bunch of blocks onto your chain, or you can use the orange 

block to have the computer repeat all commands inside that block (called a "loop"). Drag this block under the dark blue "go to" block. Then move the purple "say" block below, so it is not inside the orange "repeat" block. What does the cat do when you press the green flag?

10) To change your sprite (or add another one), hover over the small blue cat face icon near the bottom right of your screen. You can select another sprite, draw your own, or even upload a sprite from your computer. Once you load a new sprite, the see-through image on the top right of the scripts window will change to match the image of your new sprite. In order for your new sprites to do anything, you'll need to create a new sequence of commands for each sprite by adding new blocks of code to that sprite's script window.

Tips & Tricks: If you want a random sprite, you can choose the "Surprise" option.



11) If you want a backdrop that isn't a white void, hover over the small blue scenery icon at the bottom right of your screen. Once again, you can select another backdrop, draw your own, or upload an image from your computer.

12) Keep dragging and adjusting blocks of code. Can you figure out how to get the computer to react only when you do something very specific first (such as: wait until the space bar is pressed before a sprite says hello)?

Tips & Tricks: If you no longer want to use a block of code, drag it back to the library of commands and it will disappear from your script window.

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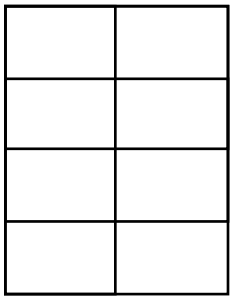
13) Now that you've learned the basics of Scratch, here's a challenge: make an interactive game to play with your family or friends. And most importantly – have fun!

ACTIVITY - MY T-SHIRT'S WATER STORY

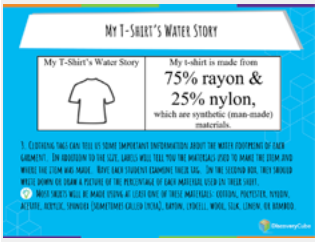
1) Have your students find an extra t-shirt or look at the label on the shirt they are currently wearing. Then, make sure they have a pen or pencil and their journal or a piece of paper.

2) Have each student find the 8 boxes printed in their journal or fold a piece of paper so it has 8 boxes:



3) In the first box, have them draw a picture of their shirt and write, "My T-Shirt's Water Story".

4) Clothing tags can tell us some important information about the water footprint of each garment. In addition to the size, labels will tell you the materials used to make the item and where the item was made. Have each student examine their tag. In the second box, they should write down or draw a picture of the percentage of each material used in their shirt.



Fun Fact: Most shirts will be made using at least one of these materials: cotton, polyester, nylon, acetate, acrylic, spandex (sometimes called Lycra), rayon, lyocell, wool, silk, linen, or bamboo.

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5) Some materials come from nature and some are synthetic, or man-made. Natural materials sometimes come from plants, and sometimes from animals, while most man-made materials come from oil, just like plastics. Still in the second box, have your students write if the material(s) found in their shirts are natural or synthetic. A copy of each chart can be found in their journals.

Fun Fact:

Material	Source	Raw Material
Cotton	Natural	Plant
Polyester	Synthetic	Oil (Plastic)
Nylon	Synthetic	Oil (Plastic)
Acetate	Synthetic	Oil (Plastic)
Acrylic	Synthetic	Oil (Plastic)
Spandex (Lycra)	Synthetic	Oil (Plastic)
Rayon	Synthetic	Plant
Lyocell	Synthetic	Plant
Wool	Natural	Animal
Silk	Natural	Animal
Linen	Natural	Plant
Bamboo	Natural	Plant

Note that rayon and lyocell are man-made (synthetic), but composed of plant matter.

6) It takes different amounts of water (and energy, which also uses water to make and transport) to make each of these materials. Cotton is a thirsty plant; it takes 715 gallons of water (that 3 years' worth of drinking water for you!) just to grow enough cotton to make one 100% cotton t-shirt. In the third box on their paper, have your students refer to the chart and write down or draw how much water it took to make their shirt.

Fun Fact: (next page)

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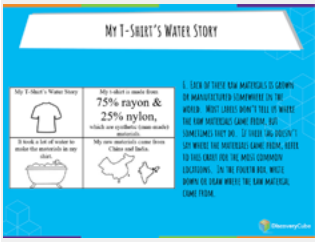
Material	Water to Grow/ Make Raw Material	Water in Energy to Make Shirt
Cotton	very high amount	low amount
Polyester	small amount	high amount
Nylon	small amount	high amount
Acetate	small amount	high amount
Acrylic	small amount	high amount
Spandex (Lycra)	small amount	high amount
Rayon	high amount	high amount
Lyocell	high amount	high amount
Wool	high amount	low amount
Silk	high amount	high amount
Linen	small amount	low amount
Bamboo	small amount	high amount

7) Each of these raw materials is grown or manufactured somewhere in the world. Most labels don't tell us where the raw materials came from, but sometimes they do. If their tag doesn't say where the materials came from, refer to this chart for the most common locations. In their fourth box, have your students write down or draw where their raw material came from.



Fun Fact:

Material	Common Raw Material Origin
Cotton	India
Polyester	China
Nylon	China
Acetate	China
Acrylic	China
Spandex (Lycra)	China
Rayon	India
Lyocell	India
Wool	China (or New Zealand)
Silk	Thailand
Linen	China
Bamboo	China

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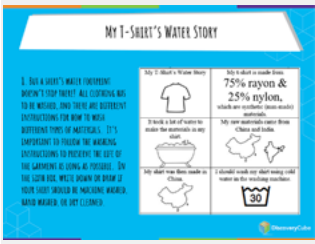
8) Where was their garment made? It takes water to move items around the globe. The further an item has to travel, the more water will be needed to ship it. In the fifth box, have your students write down or draw where their shirt was made.

Tips & Tricks: This information can be found on their tag.

9) But a shirt's water footprint doesn't stop there! All clothing has to be washed, and there are different instructions for how to wash different types of materials. It's important to follow the washing instructions to preserve the life of the garment as long as possible. In the sixth box, have your students write down or draw if their shirts should be machine washed, hand washed, or dry cleaned.

Fun Fact: While some clothing tags use words to describe the washing instructions, others use symbols. Here's what the most common symbols mean:




Do not wash

Machine wash warm


Do not iron


Hand wash


Do not bleach


Dry clean only

Machine wash cold


Tumble dry low


Do not dry clean


Hang dry only

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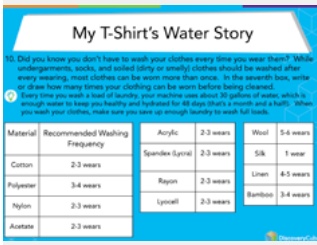
10) Did you know you don't have to wash your clothes every time you wear them? While undergarments, socks, and soiled (dirty or smelly) clothes should be washed after every wearing, most clothes can be worn more than once. In the seventh box, have your students write or draw how many times their clothing can be worn before being cleaned.

Fun Fact: Every time you wash a load of laundry, your machine uses about 30 gallons of water, which is enough water to keep you healthy and hydrated for 48 days (that's a month and a half!). When you wash your clothes, make sure you save up enough laundry to wash full loads.



Material	Recommended Washing Frequency
Cotton	2-3 wears
Polyester	3-4 wears
Nylon	2-3 wears
Acetate	2-3 wears
Acrylic	2-3 wears
Spandex (Lycra)	2-3 wears
Rayon	2-3 wears
Lyocell	2-3 wears
Wool	5-6 wears
Silk	1 wear
Linen	4-5 wears
Bamboo	3-4 wears

*Note: Undergarments, socks, and soiled clothes should be washed after every wear.

11) In the last box, have your students write or draw how long they plan on keeping this shirt and what they plan to do with it when they no longer want it.

Fun Fact: There are lots of things you can do with your shirt when it no longer fits or it has worn out. Instead of throwing it out, where it will go to the landfill, consider reusing it as a rag (and help reduce your paper towel waste), giving it to a friend or sibling to wear, donating it, or even turning it into something else (like a blanket to keep you warm or a tote bag).

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CONCLUSION

What I Discovered

To earn a portion of the Water Wise badge, have your students use their journals to help them reflect on what they discovered. We would love to see pictures or screen shots of their custom code in Scratch. Please email pictures to educationemail@discoverycube.org.

Supplies for Next Time

FROM SCIENCE KIT:

Per Student:

- ☐ graph paper
- ☐ craft stick
- ☐ 2 index cards (4"x6")

Per Classroom:

- ☐ spray bottle
- ☐ petroleum jelly

Per Group of 3-4 Students:

- ☐ large aluminum baking dish (9"x12")
- ☐ 16 oz. deli containers (3 per group)
- ☐ 8-10 oz. cups (2 per group)
- ☐ 4 oz. deli containers (3 per group)
- ☐ 1 oz. deli containers (1 per group)
- ☐ trash bag
- ☐ foil
- ☐ dusting of powdered chocolate
- ☐ few drops of food coloring
- ☐ scotch tape

SUPPLIED BY TEACHER/STUDENTS:

- ☐ tap water (in spray bottle)
- ☐ pen
- ☐ ruler
- ☐ scissors

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