CS4ALL 8-Week Food Computer Curriculum

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Curriculum Overview

FCS4ALL's curriculum teaches computer science fundamentals with an introduction to plant science and a focus on Food Computer technology. Our curriculum teaches through written and offline group activities that explore the importance of computer programming, concepts of programming languages, and the basic principles of coding. After this foundation, students complete coding activities on a computer. Our curriculum runs for eight weeks and can be used to fit a fifty to seventy minute time period.

In addition to self-contained weekly activities, students will grow plants in pots and jars and compare them to plants grown in the Food Computer over the course of the program. The plants grown in the Food Computer grow stronger and faster even though students will plant in pots and jars weeks earlier. We compare the time and effort invested in growing plants in pots and jars and contrast that with the speed and efficiency of growing plants in the Food Computer. This concrete comparison provides insight into the power of programming.

We chose to focus our curriculum around a Food Computer because its use of coding provides a concrete and material result that students can interact with. Additionally, the students we work with do not have easy access to fresh fruits and vegetables. In supporting students to grow their own produce, they can learn about where food comes from and their own power.

Grade level:

- 3rd to 5th grade

Class length:

- can be adapted to fit fifty to seventy minute time period (our time suggestions are for a sixty minute period)

- run over eight weeks

Space Needed for the Course:

- a sunlit area to store 5 potted plants and 5 plants in jars

- a 3 foot by 3 foot area in the classroom near an outlet to store the Food Computer

Materials Needed for the Course:

- notebook and writing utensils for students to write in

- whiteboard and markers

- access to laptops or a computer lab for Week 6 and Week 7 of the course

Week 1

Objectives

- Identify and learn the parts of a plant
- Learn what a plant needs to grow
- Learn what a hydroponic is and why it is useful

Outline: In this class, we will introduce ourselves to the students and the curriculum by explaining that we are going to use computer science to grow plants that we can eat. We first will cover the parts of a plant, what a plant needs to grow, and then adapt this to introduce hydroponics. Then each table of students will plant seeds in a pot (in soil) and in a jar (hydroponics) that they will continue to grow for the rest of the course.

Background: We want to use the Food Computer to demonstrate the impact that computer science and programming can have in a concrete and tangible way to the students. To do this, we will grow plants in pots and jars that sit by a window and compare these to plants grown in the Food Computer. The contrast is striking. We have to start growing the plants in the pots and jars on the first day because they will take a while to grow. Even though we do not plant in the Food Computer until later in the course, the plants grown in the Food Computer will grow to be much bigger and more fruitful than the plants in the pot and jars.

Before we reach this point, the students must learn about the parts of the plant, what a plant needs to grow, and about how to grow plants in hydroponics. It is crucial that the students understand what a plant needs to grow so that they can later understand how the Food Computer can provide the ideal environment for the plant.

Materials

- painter's tarp, everything in hydroponic and potted plant guide (linked below), survey worksheet (linked below)

Resources

- Potted plant guide: https://docs.google.com/document/d/1-69h1ump5zYW3674koNjvqUUDNdO4c-MwQxtSS6uISs/edit?usp=sharing
- Hydroponic guide: https://docs.google.com/document/d/1mDILUG0vrhkkGkkOlhKMnHA51WJzMdPzM-4xDx1x-Y8/edit?usp=sharing
- Survey worksheet (feel free to adapt to your own needs/interest): https://docs.google.com/document/d/1Okhu1zD7TAUy04RL3ksiqeJHKCtiSkKYvfvRPPzwiiY/edit?usp=sharing

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Preparation

In advance of class

1. Read over the potted plant guide. Purchase materials.
2. Read over the hydroponic guide. Purchase materials.
3. Follow step 1 of hydroponic guide and prepare cubes to germinate seeds for several days prior to the first day of class.
4. Print the survey worksheet.

Day of class

1. Bring all potted plant and hydroponic plant materials to the classroom.
2. Set up painter's tarp in area in classroom where you will be assembling the pots and jars to allow for easy clean-up.
3. Follow steps 2-5 in the hydroponic guide before class.
4. Fill up the jars with water (step 6a in hydroponic guide).

Procedure

1. **Introduction to class and curriculum** (10 min)
    a. Starting with the teachers, everyone introduces themselves by saying their name and their favorite food.
    b. Ask the class what do they use computers for?
    c. Explain that computer work by people coding them, people telling what the computer what to do.
    d. Tell the class that we are going to use coding to help us grow plants.
2. **Start a conversation about plants** (8 min)
    a. Ask for examples of plants (Flowers, trees, food (spinach, lettuce, carrots, tomatoes, etc), cactus, moss)
    b. Ask "what parts do most plants have in common?" Make a list/word bank on the board and include roots, stem, leaves, petals, seeds
3. **Students draw a plant on their own** (7 min)
    a. "Directions: in your notebook draw any kind of plant you want, but make sure it has all the parts that we just came up with that are on the board
4. **As a class, draw a plant on the board** (7 min)
    a. Ask students to share parts of their plants they added, draw part on the board and label it.
        i. For each part make sure to go over the significance
            1. Roots – soak up water and nutrients from the ground
            2. Stem – supports plants and brings water/nutrients to the rest of plant
            3. Center of flower – has all the seeds so more plants can be planted/grown
        ii. Also identify soil – holds the nutrients/water, supports the plant to stand up
    b. Go over what a plant needs to live: water, air, nutrients, sunlight
        i. "What happens if we give a plant too much/too little water/sun?
5. **Introduction to hydroponics** (8 min)

    a. “Can plants grow without soil? Yes - they can grow in water this is called hydroponic”
    b. Break down the word, ask for examples of words that have hydro/a in it: hydrate, dehydrated, fire HYDRant.
        i. “What do these words have in common? What do you think hydro means?” Write on the board that Hydro = water and Ponic = plant
    c. “Hydroponics can provide all the stuff we talked about that a plant needs - but nutrients are in the water instead of soil”
    d. Talk about pros/cons of hydroponic vs. regular plant
        i. PROS: more plants in less space, don’t have to remember to water as often
        ii. CONS: need to make space to set up (as opposed to just being outside), Have to buy separate nutrients and make sure plants have enough
6. **Make potted plants and hydroponics and conduct survey** (10min)
    a. Split the class into groups of 4-5 students each. This is done easiest by table. Each group will be responsible for one potted plant and one hydroponic plant.
    b. Explain that one group will be called up one at a time to assemble their plants. Otherwise, students should focus on filling out the survey.
    c. Pass out the survey and writing utensils.
    d. Call groups up one at a time to build their potted plant and hydroponic.
        i. Assemble the potted plant and allow a student to drop seeds into the hole.
        ii. It is recommended to have hydroponics already partly assembled - see steps 1-5 in the hydroponic guide, therefore you just need to fill jar with water/nutrients and stick the pre-made netpot into the jar. Explain the process of measuring the nutrients to the students as you do it.
7. **Go over parts of hydroponic and have the student draw this in their notebook** (10min)
    a. “Starter cube - where the seeds germinate - when the seed grows roots and starts to sprout. Starter cube helps soak up water, moist place is important for seed germination”
    b. “Clay pellets - a porous rock that soaks up water and helps to support the starter cube, and keeps the cube moist so the plant can grow”
    c. “Rope - the rope sits inside the water in the jar to soak up water and bring more water to the clay pellets/starter cube”
    d. “Nutrient A and B gives the plant nutrients”
8. **Place plants in a location that gets a decent amount of sunlight.**
    a. **NOTE:** From now on, water the plants with the students every week. We did not include this explicitly in the instructions for the following weeks because whether watering the plants at the beginning or end of class differs based on classroom dynamics. We have had success with both methods depending on the classroom.

Tips

- When you are purchasing pots and saucers for planting, buy 2 extra of each for activities for the following weeks.
- Set timers for students when they are completing activities on their own

- If your class is longer or shorter, you can extend or shorten the conversational portions or the time given for students to complete activities on their own.

Extra Resources

- Refer to each table by a flower name and use these to label and identify the plants for each group.
    - Images for Rose, Tulip, Sunflower, Daisy, and Lily you can print out and paste onto pots and jars https://docs.google.com/document/d/1yH5tOqT4GP_D5Oxgwqpd5I_QUR2dyJnKdnBAGX0YuWs/edit?usp=sharing

Week 2

Objectives

- Understand how much we rely on computers in everyday life
- Learn that computers only work because we tell them what to do (programming)
- Understand that computers need extremely specific directions in order to work
- Practice thinking sequentially

Outline: In this class, we will review the parts of a plant and what a plant needs to grow. We will think of ways that computers help us in everyday life and focus on the idea that computers help us but they only know what we tell them. We will demonstrate this by having the students write instructions for a computer on how to plant seeds in a pot. You will act as a computer and have them read out their instructions. By interpreting their instructions literally, you will explain that they need to be specific about their instructions because computers have no inherent knowledge of their own. You will end class by summarizing a list of instructions that the computer can understand.

Background: To understand the importance of computing, students should reflect on how many things we can and do use computer for. It is easy to think of computers as a magical and powerful black box but it is absolutely crucial that students then understand that computers only work and are helpful because they are listening to what humans have told them to do. It is imperative that students understand that humans create and direct how computers work so that they realize that they have the power to control and direct computers as well. To do this, we emphasize how “dumb” computers are and the importance of being specific in providing instructions to the computer. When we pretend to be a computer, we want the students to understand that computers only work because humans tell them exactly what to do and if humans tell them the wrong or vague thing then computers will not know any better. We want to build a strong foundation of students understanding that we tell computers what to do so that the idea of programming becomes natural and inherent to their perspective on computers.

Materials

- painter’s tarp, 1 pot, 1 saucer, soil, watering can and water, packet of seeds, spade

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Preparation

Day of class

1. Set up painter’s tarp with the pot, saucer, soil, watering can, seeds, and spade on it. Make sure that the entire classroom will be able to see.

Procedure

1. **Review last week** (10 min)

a. Ask students for the different parts of the plants, and challenge them to think of what each part does for the plant. Draw each part on the board as they call them out.
    i. Answer: Seed, roots, stem, leaves, petals, center (with seeds)
b. Differentiate between what a plant is vs. what a plant needs to grow
    i. Sometimes students will mix these up. It may be helpful to explain this in terms of a human.
        1. Example: “We need food and air to grow but that doesn’t mean we are the same as spaghetti.”
c. Ask students what is needed for plants to grow. Draw and write on the board.
    i. Answer: Light, air, water, nutrients
d. Review what a hydroponic is
    i. “What does hydroponic mean? Growing plants in water”
    ii. “How is it different than growing plants in soil? We grow plants in water so we don’t have to water them. We add nutrients to the water.”
    iii. “How does a plant get everything it needs to grow as a hydroponic? We place the hydroponic by the window or under a lamp, gets air from the room, it sits in water, and we put nutrients in the water.”

2. **Discuss how do computers help us** (10 min)
    a. Remind the students that the end goal of the class is to use a computer to help us make our plants grow. Then we want to ask: what are other ways computers help us in everyday life?
    b. Ask students to give examples how computers help them in their life? In these questions and answers we want to focus on how computers can help us do things we don’t want to do and make our lives easier, but we have to tell the computer what to do.
        i. GPS - We have to tell it where we want to go
        ii. Roomba (self driving vacuum cleaner) - “We can tell computers to do things for us because maybe we don’t want to do it all the time”
        iii. They might equate the internet with computers in general - this can all be categorized as gathering information
        iv. Weather - computers help us determine things like temperature, humidity/other meteorological measurements
    c. “In order for computers to help us, we need to tell them what to do - Computers are “dumb,” they only know what we tell them.”
        i. Use their examples to explain this.
        ii. “Because computers only know what we tell them, we need to be very specific and say exactly what we mean because computers are not as smart as us. We have to translate what we want them to do and make sure they do not get it wrong”
3. **Students write directions for a computer to pot a plant in soil** (10 min)
    a. “Directions: Write in your notebooks a step by step guide for a computer for how we potted the plant in soil”
        i. Tell them to try to write directions for someone who has no experience with planting before
        ii. Go over the first instruction as a class to get them started
            1. “Step 1: Get a pot”
4. **Imitate Computer** (25 min)

a. Have students share their directions one at a time, but you are acting as the computer. Take each direction extremely literally.
    i. If a student says “put dirt in the pot”, take the entire bag of soil and attempt to put it in the pot. If a student says “take dirt out of the bag and put it into the pot,” keep adding soil to the pot until it overflows. Ask them to give you measurements or indicators like “fill the pot halfway with soil” or “fill the pot with 2 cups of soil.”
    ii. If a student says “put seeds in the pot,” take the seed packet and put it in the soil.
    iii. If a student says “water the pot,” keep pouring until someone says to stop. Ask them to give you measurements or indicators like “water the pot for one second” or “water the pot until the soil is wet.”
    iv. Be creative with how you interpret the instructions! This is a fun activity and students love it. Make sure you emphasize that you are doing exactly as they say and if they want you to do something different, they need to be more clear and precise about what they want you to do.
b. As a class, come up with a set of directions that are specific enough for the computer
    i. An example set of directions are:
        1. Get a pot
        2. Pour 1 cup of soil into the pot from the bag
        3. Take 3 seeds out of the packet
        4. Make a hole in the soil ½ way down the middle of the pot
        5. Put the seeds in the hole
        6. Cover the hole with dirt so you can’t see a hole
        7. Pour 1 tablespoon of water in the pot
        8. Move the pot to a location with sunlight
c. Write the “good” instructions on the board and have students copy them into their notebooks

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Tips

- The imitating computer activity can get messy, like when you pour too much water or put too much soil, so make sure you are prepared for this and are not near any electronics.

Week 3

Objectives

- Understand pH is a measure of how acidic something is
- Understand why it is important to measure things

Outline: In this class we will go over the concept of measurements. We will discuss what happens when a plant gets too much or too little of something that is needs and connect this to the idea that we need to take measurements to help us grow our plants. We will explain what pH is and compare the idea of the pH scale to taking the temperature. The students will conduct an experiment where they test different liquids for their pH and then guess what the liquid is.

Background: In order to highlight the benefits of using a computer, the students need to understand the importance of measurements because then we can explain that computers can take the measurements for us. We will explore taking measurements by doing a pH experiment which students typically love because of how the litmus test strips change color when you dip them into liquids of different pHs. Ultimately we want to tie this back into the idea that it is important to take measurements of different sorts to ensure the health of our plants.

Materials

- cups, dish soap, baking soda, water, lemon juice, vinegar, litmus strips, pH worksheet (linked below)

Resources

- pH experiment worksheet: https://docs.google.com/document/d/1Zv-B5svCuT7LVVJH-9mJXYnXGTZgbPCewzvsw2AkpmU/edit?usp=sharing

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Preparation

In advance of class

1. Find/purchase 25 cups (assuming you have 5 groups/tables), dish soap, baking soda, lemon juice, vinegar, and litmus strips.
2. Print out the pH experiment worksheet for each student.

Day of class

1. Pour water, dish soap and water, baking soda and water, lemon juice, and vinegar into 5 cups each. You will be giving each table one cup of each at a time for today's activity.

Procedure

1. **Review** (7 min)
    a. Go over what we did last time – "when talking to a computer how do we have to be? What happened when we did and didn't follow those rules?"

2. **Introduction to measurements** (10 min)
    a. Go over the things a plant needs to survive and then translate the conversation to talk about why it is important to measure things in order to keep our plants healthy.
        i. “A plant needs water to grow but what happens if a plant doesn’t get enough water or too much?”
        ii. “A plant needs sun but what happens if a plant doesn’t get enough or too much light?”
        iii. “What happens if a plant is too cold or too hot?”
    b. “A plant needs certain conditions to grow. Because of this, it is important to measure things to make sure we are giving the plant the best environment for it to grow! For example, we measure the temperature to know if it is too cold or too hot for our plant.”
    c. “What else could we measure about a plant that helps us know how our plant is doing?”
        i. Height, moisture
3. **Introduction to pH** (15 min)
    a. Segway conversation to include pH level as a measurement. “pH is the measure of how acidic something is”
        i. “If the soil or water for a plant is too acidic or not acidic enough, a plant could die!”
    b. Explain that pH is similar to temperature because it has a scale. “In temperature we have hot and cold and for the pH scale we have acidic and basic.”
    c. Explain that the pH scale is represented by colors and numbers. Draw on the board the different colors and label them.
4. **pH experiment** (25 min)
    a. “We are going to do our own experiment of testing/measuring for pH level”
    b. In advance you prepared each substance in a cup. One by one, give every group a cup of the same substance and allow them to dip a litmus test strip. Have them fill out the corresponding worksheet.
    c. After you hand out each cup, go around and help the kids decipher the litmus strip color and whether that means the liquid is basic, neutral, or acidic.
        i. Students may have difficultly understanding the scale. You can make a comparison to stop lights where red means stop, yellow means caution, and green means go. Similarly pH tests show that color gives us information and we can choose to respond based on what we understand from it
    d. After all cups are handed out, go over the answers as a class. Allow them to make guesses for what the substance is.
        i. water (neutral), soap mixed with water (basic), baking soda mixed with water (basic), vinegar (acidic), lemon juice (acidic)
    e. Ask the class why measuring things are important.
        i. “What would happen if we tried to grow a plant in lemon juice?”

Week 4

Objectives

- Design a Food Computer based on the needs of a plant
- Identify the parts of the Food Computer
- Understand how the Food Computer helps plants inside of it grow
- Come up with instructions to give a Food Computer to help grow plants

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Outline: In this class, the students will review what a plant needs to live in order to design a box that can grow plants inside of it. This is like their own Food Computer. Then we will reveal the Food Computer and go over its parts and place the plants inside as a class. We end by brainstorming what instructions we can give to the Food Computer to help us grow plants.

Background: We want to empower students to design and build solutions for growing plants in a box and inspire them by showing that it can be built. We will elaborate on their designs by demonstrating that in addition having light, water, air, and nutrients, we can also add a computer to the box in order to help us take care of the plants. Over the next several weeks, students will see how the help of a computer can facilitate rapid growth in the plants.

Materials

- Food computer

Preparation

In advance of class

1. Build Food Computer based on guide (**Note:** This takes 10-20 hours of work)
2. Germinate starter cubes for Food Computer

Day of class

1. Bring in Food Computer and put it somewhere that the students will not see it.
2. Assemble the net pots with the germinated start cubes and set aside so that the students will not see it.

Procedure

1. **Review what a plants needs to live** (10 min)
    a. “What does a plant needs to live? Air, water, sun, nutrients”
    b. “Let’s brainstorm places where plants can grow well and places plants may not grow so well”
        i. “Outside in the sun, but during what season? During spring/summer/fall”
        ii. “Next to a window if inside”
        iii. “Plants cannot grow in outer space because there is no air! What about super hot, dry places? What about in the middle of a bustling city? What can we do?”

2. **Students design their own box to grow plants** (15 min)
    a. "What if you wanted to grow plants in some of these locations?"
    b. Instruct students to "invent" a special box that they can bring anywhere to grow plants
        i. "Think about what the box needs to meet all of the requirements for growing plants that we talked about earlier"
        ii. Have them design their "box" in their notebooks, encourage them to be as creative as possible.
        iii. "Also think about what kind of things we may want to keep track of inside the box to help our plants grow" (i.e. temp, humidity, pH level)
    c. After about 10 min of individual/group brainstorming start sharing with the class
        i. "What were some ideas you had to incorporate light/air/water into your invented box?"
3. **Introduce the Food Computer** (15 min)
    a. "What you designed is a kind of a Food Computer!"
    b. Show them that this is a real invention that can help us grow plants in places that we may not expect - like in very urban environments
    c. Go over each part of the food computer and what role it plays
        i. Light at the top - sunlight
        ii. Fan/air pump into the water - air
        iii. Big basin - holds water
        iv. We add our own nutrients to the water
        v. Humidity sensor
        vi. Computer! - raspberry pi on the side - this is the brain that controls all of the parts we just went over
        vii. Colors of the wires - relate to color coding they have seen in traffic lights
    d. Plant the net pots in the Food Computer. Add water to the basin, add nutrients to the water and add the net pots to basin
4. **Brainstorm instructions to the Food Computer** (10 min)
    a. "Can we brainstorm as a class what kind of directions we might want to give to the brain of the food computer?"
    b. "How can we mimic the sun light? The sun is not shining all 24 hours a day, so what times would we want to turn on/off the light?"
        i. Do you want to wake up early to do this every day? No!"
        ii. Sample direction: set light to "on" when time is 6am, set light to off when time is 5pm, repeat every day
            1. Remember to be specific about repeat, and morning vs. night
    c. Introduce the idea of conditional statements (if-then statements)
        i. "What if it is too humid/hot inside the food computer?"
        ii. "We have a sensor telling us what is the current humidity? But what do we want the computer to do if the humidity reader says it's really high? - turn on fan"
            1. Sample direction: **if** the humidity/temp is greater than 60%, **then** turn on the fan
                a. Make sure it's not just saying "too high" we want to be precise

Extra Resources

- Background on conditionals: https://www.mathplanet.com/education/geometry/proof/if-then-statement

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Tips

- You may need an extension cord to be able to put the Food Computer in a location where the students can easily see it.

Week 5

Objectives

- Introduced to concept of a loop
- Understand concept of programming language
- Understand the process of problem solving in coding (abstract problem to specific code)

Outline: In this class, we will check on the growth in the Food Computer and compare it to the plants growing in pots and jars. The students will reflect on why the growth is different. Then the students will write directions for moving a plant from one table to another by only using certain phrases. You will act out the directions and then repeat the activity for moving three plants from one table to another. Then we will relate this to the concept of a programming language and the process of problem solving with code.

Background: Students will continue to build on their understanding of the power of coding and computer science this week. By comparing the growth in the Food Computer to the plants grown in pots and jars, the students will begin to see the power and possibilities of technology. Although the pots and jars have been growing for longer, the growth in the Food Computer will be greater and hardier demonstrating how much a difference using technology can make. The activity with the word bank will further the students' understanding that computers can only execute what we tell them and we need to be absolutely precise when we tell them what to do. The idea of programming languages and the process of translating a problem into specific code serve as a foundation for the students to begin coding in the following weeks.

Materials

- Word bank worksheet (linked below)

Resources

- Word bank worksheet
  https://docs.google.com/document/d/1p9GcuSSSjB41txEwFdpZsAvNNB5cY3-aKQMb21vHZFI/edit

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Preparation

In advance of class

1. Print out a couple of word banks for every table and cut them out so that multiple students at a table can look at them.

Day of class

1. Choose what table is going to be Table A and Table B. Be conscious of the directions needed to get from Table A to Table B and make sure it will be simple and clear enough when using the directions from the word bank.

Procedure

1. **Review the parts of the Food Computer** (8 min)
    a. Have students explain how each part works
2. **Check on plants in Food Computer** (8 min)
    a. “How much have they grown?”
    b. “Why do you think they are growing so fast? We are creating the perfect conditions for the plants, so they grown faster”
    c. “Why might the other plants not growing as fast? Not getting enough light, water, air… sometimes plants don’t sprout at all”
3. **Loop Activity Part 1** (15 min)
    a. “Write instructions to move one plant from table A to table B, BUT your instructions can only use phrases from the word bank”
    b. Call on student to share one direction at a time. Instructor pretends to be a computer, follow exactly what they say even if it’s incorrect.
        i. If the students do not say exactly the phrase in the word bank, don’t do anything and insist that you only understand the phrases in the word bank.
    c. Redo with best combined directions
4. **Loop Activity Part 2** (10 min)
    a. “Now, write instructions to move 3 plant from table A to table B- try to use the idea of repeat or loop”
        i. Emphasize that rewriting the same directions 3 times is inefficient, and you can just say repeat this same set for directions x number of times.
    b. Again, call on student to share one direction at a time. Instructor pretends to be a computer, follow exactly what they say even if its incorrect.
        i. If the students do not say exactly the phrase in the word bank, don’t do anything and insist that you only understand the phrases in the word bank.
5. **Introduce the concept of programming languages** (10 min)
    a. “Computers don’t understand every word we know. We have to speak only uses phrases that the computer understands, like only using phrases from the word bank. If you say something to the computer outside of this, it won’t know what you are saying. There are only a predefined set of things that the computer knows. As humans we need to figure out how to get the computer to solve our problem only by using the phrases that it knows”
    b. “The activity you did today is exactly how programming works - we think of something we want help from the computer to do, then we think of a way to do this, then we translate the directions into words that the computer understands.”

Week 6

Objectives

- Use code to solve puzzles
- Apply coding fundamentals learned offline in online environment

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Outline: Students will have time to code on their own or in pairs. We use Hour of Code activities from Code.org, as they are intentionally designed to build up a student's conceptual and practical understanding of programming in short and fun activities.

Background: After introducing students to concepts about programming like sequential thinking, providing specific instructions, and loops, we want to allow students to get their hands dirty and code! Students are typically eager to get on the computers and start coding. Some students may find coding easier than others. It is important to remind students who struggle this activity that no matter how experienced someone is at coding, they will always struggle and get stuck at some point. Try to encourage their effort and attempts rather than only applauding them when their code works.

Materials

- Computers/laptops for the students

Resources

- Initial coding task: https://code.org/playlab
- Other coding tasks: https://code.org/hourofcode/overview

Preparation

In advance of class

1. Play through the Classic (or Gumball) version on https://code.org/playlab so that you become familiar with the interface and will be equipped to answer questions for the students.

Procedure

1. **Review with the students what they know about computer science** (10 min)
    a. Remind them of the computer imitation activities and what they learned: computers only do what we tell them to do and we need to tell them exactly what to do and in exactly the correct order
    b. Review last class discussion about computer languages: we need to talk in a language that the computer understands
2. **Students try coding!** (50 min)
    a. Pass out laptops/go to computer lab and ask the students to type https://code.org/playlab into their browser and play the Classic version.

i. It is helpful for all the students to play through the same activity so that they can help each other if one student is struggling.
ii. If a student is struggling, you may encourage another student to explain how to do a certain activity, but do not allow the other student to do the activity for them.
iii. If a student finishes the Classic version early, allow them to go back to select another. Other activities can be found https://code.org/hourofcode/overview. We recommend the following:
    1. https://studio.code.org/s/infinity/stage/1/puzzle/1
    2. https://studio.code.org/s/starwarsblocks/stage/1/puzzle/1
    3. https://studio.code.org/s/frozen/stage/1/puzzle/1

Week 7

Objectives

- Use code to solve puzzles
- Apply coding fundamentals learned offline in online environment

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Outline: Students will have time to code on their own or in pairs. We use Hour of Code activities from Code.org, as they are intentionally designed to build up a student's conceptual and practical understanding of programming in short and fun activities. This week we also allow student to try coding by typing to make art with http://art.kano.me/challenges/basic/.

Background: We want to allow students to code! Some students may find coding easier than others. It is important to remind students who struggle this activity that no matter how experienced someone is at coding, they will always struggle and get stuck at some point. Try to encourage their effort and attempts rather than only applauding them when their code works.

Materials

- Computers/laptops for the students

Resources

- Hour of Code Activites:
  https://studio.code.org/s/infinity/stage/1/puzzle/1
  https://studio.code.org/s/starwarsblocks/stage/1/puzzle/1
  https://studio.code.org/s/frozen/stage/1/puzzle/1
- Coding Art: http://art.kano.me/challenges/basic/

Preparation

In advance of class

1. Play through activities on http://art.kano.me/challenges/basic/ so that you become familiar with the interface and will be equipped to answer questions for the students.

Procedure

1. **Ask students what they liked and didn't like about coding last class** (10 min)
    a. Respond to their likes and dislikes
    b. Remember to highlight how it is normal to be frustrated while coding because it is like learning a new language
        i. You wouldn't expect to be able to speak Spanish the first time you tried and coding is the same way
2. **Students code!** (50 min)

a. If the students enjoyed what they did last week, allow them to return to https://code.org/hourofcode/overview and choose between the following:
    a. https://studio.code.org/s/infinity/stage/1/puzzle/1
       https://studio.code.org/s/starwarsblocks/stage/1/puzzle/1
       https://studio.code.org/s/frozen/stage/1/puzzle/1
b. If the students want to try something different and typing out code, allow them to go try http://art.kano.me/challenges/basic/

Week 8

Objectives

- Understand the advantage of using a Food Computer
- Understand how coding can help us in everyday tasks

Outline: We will review the experience of coding with the students. Then we will compare the plants they grew to the plants grown in the Food Computer. This will facilitate a discussion about why using a computer is helpful and what advantages it provides. The students will try the lettuce grown in the Food Computer to see the concrete impact computers can make. We will end with taking the same survey we started the course with and by reflecting on what students enjoyed about the program.

Background: In order to fully solidify what the students have learned, we want them to directly compare the plants they grew in the pots and jars to the plants grown in the Food Computer. This is an obvious and concrete measure to demonstrate the power of coding.

Materials

- Candy, survey worksheet (linked below)

Resources

- Survey worksheet (feel free to adapt to your own needs/interests) https://docs.google.com/document/d/1Okhu1zD7TAUy04RL3ksiqeJHKCtiSkKYvfvRPPzwiiY/edit?usp=sharing

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Preparation

In advance of class

1. Print survey worksheet
2. Purchase candy

Procedure

1. **Ask students what they think about coding** (10 min)
    a. Ask students how coding last class was similar or different for them compared to the first class
    b. Ask students who did the art.kano activities if they preferred that or if they preferred the drag and drop. Explain that most coding is done by typing instead of the drag and drop
2. **Compare plants grown in pots and jars to Food Computer** (20 min)
    a. Each table gets their potted plant and hydroponic and compare the regular plants to the Food Computer plants in their notebooks
    b. Discuss what the similarities and differences are

    c. Discuss as a class why the plants grown in the Food Computer are bigger even though they were planted later
        i. We can give the plant more light, we can control how much air the plant gets
    d. Discuss why using a computer is helpful
        i. Because we can control the light and other conditions without always being present with the plants
    e. Have the students draw the difference between the plants they grew and the plants in the Food Computer
3. **Eat plants from the Food Computer and conduct survey** (10 min)
    a. Explain to the kids that everyone will come up and be able to try the food grown in the Food Computer.
    b. Pass out the survey. You will call out a table to come up one at a time and try the plants in the Food Computer and everyone else should be working on the survey.
4. **Students reflect on course** (10 min)
    a. When students are done with the survey have them write down 1 thing that they learned and 1 thing that they liked most about the program.
    b. Go around the room and have everyone say either 1 thing that they learned or 1 thing that they liked most about the program. Allow the kids to come up and grab a piece of candy after they answer.
5. **Thank the kids for their time and attention over the course of the program!**

Extra Resources

- Contact us and let us know how the program went! (lkassir1@jhu.edu, ocapori1@jhu.edu)