

## **The Arts in STEM - Advancing Meaningful Integration**

### **Arts Integrated Lesson Plan**

Paul

Pavao

### **Plants – Seed Growth**

#### **Stop Motion Animation Seed Germination with Vidcode**

This lesson is part of a 3<sup>rd</sup> grade Unit of Inquiry into Plants. The expected time frame is 7 40-minute periods over 3 days. (We have double blocks of time for our inquiry units in the afternoon, i.e. 2x40 minutes).

#### *Central Idea*

Plants have distinct characteristics that make them vital to humans and the planet.

#### *Lines of Inquiry*

- Parts of a plant
- The growth of plants
- How plants and soils are important to the planet

### **Shanghai Community International School Unit Outcomes**

#### ***Skills***

- a. Use a variety of instruments and tools to measure data accurately.
- b. Use scientific vocabulary to explain their observations and experiences.
- c. Identify or generate a question or problem to be explored.
- d. Plan and carry out systematic investigations, manipulating variables as necessary.
- d. Make and test predictions.

#### ***Overall Expectations***

- a. Assess ways in which plants have an impact on society and the environment, and ways in which human activity has an impact on plants and plant habitats;
- b. Investigate similarities and differences in the characteristics of various plants, and ways in which the characteristics of plants relate to the environment in which they grow;
- c. Demonstrate an understanding that plants grow and change and have distinct characteristics.

#### ***Learning Outcomes***

- 3.1.1 Assess ways in which plants are important to humans and other living things, taking different points of view into consideration (e.g., the point of view of home builders, gardeners, nursery owners, vegetarians), and suggest ways in which humans can protect plants.
- 3.1.2 Assess the impact of different human activities on plants, and list personal actions they can engage in to minimize harmful effects and enhance good effects.
- 3.2.1 Follow established safety procedures during science and technology investigations (e.g., avoid touching eyes when handling plants; never taste any part of a plant unless instructed to do so by the teacher).

3.2.2 Observe and compare the parts of a variety of plants (e.g., roots of grass, carrot, dandelion; stem of cactus, carnation, tree; leaves of geranium, spider plant, pine tree).

3.2.3 Germinate seeds and record similarities and differences as seedlings develop (e.g., plant quick-growing seeds – nasturtium, morning glory, sunflower, tomato, beet, or radish seeds – in peat pellets to observe growth).

3.2.4 Investigate ways in which a variety of plants adapt and/or react to their environment, including changes in their environment, using a variety of methods (e.g., read a variety of non-fiction texts; interview plant experts; view DVDs or CDCROMs).

3.2.5 Use scientific inquiry/experimentation skills, and knowledge acquired from previous investigations, to investigate a variety of ways in which plants meet their basic needs.

3.2.6 Use appropriate science vocabulary, including stem, leaf, root, pistil, stamen, flower, adaptation, and germination, in oral and written communication.

3.2.7 Use a variety of forms (e.g., oral, written, graphic, multimedia) to communicate with different audiences and for a variety of purposes (e.g., make illustrated entries in a personal science journal to describe plant characteristics and adaptations to harsh environments).

3.3.1 Describe the basic needs of plants, including air, water, light, warmth, and space.

3.3.2 Identify the major parts of plants, including root, stem, flower, stamen, pistil, leaf, seed, and fruit, and describe how each contributes to the plant's survival within the plant's environment (e.g., the roots soak up food and water for the plant; the stem carries water and food to the rest of the plant; the leaves make food for the plant with help from the sun; the flowers grow fruit and seeds for new plants).

3.3.3 Describe the changes that different plants undergo in their life cycles (e.g., some plants grow from bulbs to flowers, and when the flowers die off the bulb produces little bulbs that will bloom the next year; some plants grow from germination of a seed to the production of a fruit containing seeds that are then scattered by humans, animals, or the wind so that new plants can grow).

3.3.4 Describe how most plants get energy to live directly from the sun (e.g., plants turn the energy from the sun into food for themselves) and how plants help other living things to get energy from the sun (e.g., Other living things, which cannot "eat" sunshine, eat the plants to get the energy. They also get energy when they eat the animals that eat the plants).

3.3.5 Describe ways in which humans from various cultures use plants for food, shelter, medicine, and clothing (e.g., food – from rice plants; houses for shelter – from the wood of trees; medicines – from herbs; clothing – from cotton plants).

3.3.6 Describe ways in which plants and animals depend on each other (e.g., plants provide food for energy; animals help disperse pollen and seeds and provide manure that fertilizes the soil in which plants grow; plants need the carbon dioxide that animals breathe out, and animals need the oxygen that plants release into the air).

3.3.7 Describe the different ways in which plants are grown for food (e.g., on farms, in orchards, greenhouses, home gardens), and explain the advantages and disadvantages of locally grown and organically produced food, including environmental benefits.

3.3.8 Identify examples of environmental conditions that may threaten plant and animal survival (e.g., extreme heat and cold; floods and/or droughts; changes in habitat because of human activities such as construction, use of gas-powered personal watercraft on lakes).

NCAS Visual Arts: Connecting and Media Arts: Producing (Grade 3)

VA:Cn10.1.3.a Develop a work of art based on observations of surroundings.

MA:Pr.4.1.3 Practice combining varied academic, arts, and media forms and content into unified media artworks, such as animation, music, and dance.

*ISTE Standards for Students*

Computational Thinker 5D: Students understand how automation works and use algorithmic thinking to develop a sequence of steps to create and test automated solutions.

Creative Communicator 6C: Students communicate complex ideas clearly and effectively by creating or using a variety of digital objects such as visualizations, models or simulations.

CCSS English Language Arts - Writing (Grade 3)

3.W.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly.

3.W.2.a Introduce a topic and group related information together; include illustrations when useful to aiding comprehension.

3.W.2.b Develop the topic with facts, definitions, and details.

3.W.2.c Use linking words and phrases (e.g., also, another, and, more, but) to connect ideas within categories of information.

3.W.2.d Provide a concluding statement or section.

CCSS Mathematics - Measurement and Data (Grade 3) and Standards for Mathematical Practice

3.MD.2 Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l). Add, subtract, multiply, or divide to solve one-step word problems involving masses or volumes that are given in the same units, e.g., by using drawings (such as a beaker with a measurement scale) to represent the problem.

3.MD.3 Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one-and two-step “how many more” and “how many less” problems using information presented in scaled bar graphs. For example, draw a bar graph in which each square in the bar graph might represent 5 pets.

MP1 Make sense of problems and persevere in solving them.

MP2 Reason abstractly and quantitatively.

MP3 Construct viable arguments and critique the reasoning of others.

MP4 Model with mathematics.

MP5 Use appropriate tools strategically.

MP6 Attend to precision.

MP7 Look for and make use of structure.

MP8 Look for and express regularity in repeated reasoning.

### **Engage (Day 1 ~40minutes)**

At this point of the unit, the students will have watched [Mystery Science – Plant Adventures: Do Plants Eat Dirt?](#), and have already completed their Root Viewer worksheet (see handout below), and will have carefully drawn 5-7 images (one each day, over the course of 5-7 school days) of their seed germinating.

To engage students in preparation for their own stop motion coding project, students will watch the following video:

Germination of a seed (time lapse) <https://www.youtube.com/watch?v=oDBX2gCXxYw&vl=en>

They will be told that they will be constructing their own stop motion time lapse using the drawings they have made from their observations of their root viewer.

Students will then be shown the teacher’s Vidcode stop motion project:

<https://www.vidcode.com/share/70bTUtpkZI> as an introduction to the Vidcode coding platform.

Following the teacher’s stop motion video, students will use the Visible Thinking strategy of “Think, Pair, Share”. Students will be asked to look at the written code beside the video and think about what it means. Students will be given about 30-40 seconds to individually think about the code before turning to the person beside them to “pair and share” their observations and ideas on what the code means. Students will be given about 1 minute (30 seconds each) to share their ideas with each other. Students will then be invited to share their thoughts and ideas with the class.

### **Explore (Day 2 ~80 minutes)**

The teacher will “explain that stop motion is useful for demonstrating a process or sequence of events because you can show how something evolves and changes. [Emphasis should be placed on] the importance of order in a stop motion animation. Point out that the process or sequence would not make sense if the pictures were not in order.” (“Stop motion lesson plan,” n.d.)

The teacher will explain that an array is an ordered list of data that can hold words, numbers, objects, and more. (e.g. [“image1.png”, “image2.png”, “image3.png”]). Point out the array of images in the teacher’s Vidcode project.

Students will then investigate the Vidcode platform and complete the ‘Slide Show’ tutorial to construct a simple, coded stop motion video, using preset photos already in Vidcode.

### **Explain (Day 3-4 ~80 minutes each day)**

Students will be given the *Stop Motion Planning Sheet* (see handouts) to illustrate and develop their own stop motion seed germination using the drawings they have already made of their own seed. They will also be given the *Creative Coding Project Assessment Rubric* (see handouts) to help guide their project, as well as the teacher created *Rubric for Assessing Arts in STEM* (see handouts). A copy of the *Creative Coding Cheat Sheet* (see handouts) and the *Rubric for Assessing Arts in STEM* will be displayed on the SmartBoard for student reference.

Students will use their planning sheet to then create their own seed germination stop motion animation in Vidcode. Using iPads, students will take photos of their 5-7 drawings to be uploaded and used in Vidcode.

Time permitting, students will share their projects with the class using the SmartBoard.

### **Extend (Day 5 ~80 minutes)**

The class will view 2-3 examples of the stop motion animations that were created and review what an array does.

Students will discuss what might happen when the interval is changed to 1000 or 100, and why.

Students will then analyze their code and make adjustments in order to create a filter that supports the theme of their movie using small lines of code like `grayscale()` and `tint("red", 10)`; and/or add a title using the `text` function. ("Stop motion lesson plan," n.d.)

Time permitting students will share their updated projects with the class.

### **Evaluate**

Formative assessment is ongoing throughout the lesson through check-ins and debriefings with students during their planning phase, along with teacher observations.

Student will self-assess using the BrainPop *Creative Coding Project Assessment Rubric* (see handouts) and the *Rubric for Assessing Arts in STEM* and the teacher will also assess each student using the same rubrics. Students will use the comments box at the bottom of the rubric to write a 2-3 sentence reflection on their project (what worked well, what was difficult).

### **Resources**

*Creative coding cheat sheet*. (2016, June). Retrieved from <https://cdn-educators.brainpop.com/wp-content/uploads/2017/06/Creative-Coding-“Cheat-Sheet”-1.pdf>

*Creative coding project assessment rubric*. (2017, June). Retrieved from <https://cdn-educators.brainpop.com/wp-content/uploads/2017/06/CreativeCodingRubric.docx.pdf>

Gardening at 58 north. (2016, July 8). *Germination of a seed (time lapse)*. [Video file]. Retrieved from <https://www.youtube.com/watch?v=oDBX2gCXxYw&vl=en>

Mystery science. (n.d.) *Do plants eat dirt?* Retrieved from <https://mysteryscience.com/plants/mystery-2/roots-water-minerals/85?r=45284389>

Plants - grade 2 - root viewer worksheet 9-4-14. (2014, September 4) Retrieved from <https://docs.google.com/presentation/d/184AdAyQu7Tu98WOIGWLh20ZSAQdi9OuD9qHyJrGVxGY/edit#slide=id.p>

Project zero. Harvard graduate school of education. (2015). *Think, pair, share*. Retrieved from <http://pz.harvard.edu/resources/think-pair-share>

*Seed germination process clipart.* (n.d.). Retrieved from <https://www.kissclipart.com/seed-germination-process-clipart-germination-seed-my66on/download-clipart.html>

Stop motion lesson plan. (n.d.). Retrieved from <https://educators.brainpop.com/lesson-plan/stop-motion-lesson-plan-creative-coding/>

*Stop motion planning sheet.* (2017, July). Retrieved from [https://cdn-educators.brainpop.com/wp-content/uploads/2017/05/CC\\_stopMotion\\_plan.pdf](https://cdn-educators.brainpop.com/wp-content/uploads/2017/05/CC_stopMotion_plan.pdf)

## Handouts

SYSTEM



## Plan: Stop Motion Animation

Name: \_\_\_\_\_  
Date: \_\_\_\_\_  
Class: \_\_\_\_\_

Plan a stop motion animation about \_\_\_\_\_.

1			
2			
3			



Draw what happens in each box.




Write what is happening on the lines.

4			
5			
6			

Need more frames?  
Flip this sheet over and draw more boxes and lines on the back.



## Creative Coding “Cheat Sheet”

### Stop Motion

`movie = stopmotion(frames, interval)`

`movie = stopMotion(['sample-1', 'sample-2', 'sample-3'], 250);`

mov creates a stop motion, made up of frames (images), and an interval (how fast the images switch)

`my movie.frames = ['fish-1', 'fish-2', 'fish-3'];`

my modifies the frames of the movie

`my movie.frames.push("another-frame")`

my add a frame to the existing frame array

`my movie.interval = 700;`

my modifies the speed of the movie

### Te:

`var Filters (Stop Motion project)`

Change the numbers and strings to change the amount and type of filter.

`black_and_white(5)`

the accepts a number between -100 and 100 which skews the bias for a given pixel to be black (-100) vs the white (100).

`var blur(amount);`

Add blurs video

In y [ler](#)

`my color_invert()`

my inverts video colors

`my vignette(amount, x, y);`

my creates a border around a project. x and y change the position of that border.

`my vignette(55);`

`my vignette(55, 220, 50);`

my create a border around a project. x and y change the position of that border.

my `my_text.size = 50;`

my modifies the size of your text

`exposure(amount);`

lightens video

`sepia();`

adds a warm sepia effect

`tint(color, amount);`

`tint("red", 35);`

adds a color overlay to project

`grayscale();`

turns video gray

`motion_blur(amount);`

adds motion blur effect

`noise(amount);`

adds visual noise

`pixelate(amount);`

adds a pixelated effect

### Graphics (Meme project)

`var my_graphic = graphic(source, x, y)`

`var my_graphic = graphic("create");`

adds a graphic

`my_graphic.source = "rainbow";`

modifies the image file of the graphic

`my_graphic.x = 10;`

moves the graphic horizontally (left and right)

`my_graphic.y = 10;`

```
my_repeat.start();
```

starts repeat (if it was stopped)

```
my_repeat.interval = 200;
```

modifies how often the code inside repeat gets run in milliseconds

### Conditional Statements (useful for Newscast project)

Remember that every open bracket { must have a matching closing bracket }

```
if (condition) {
```

```
    //code that will run if condition is true
```

```
}
```

```
if (condition) {
```

```
    //code that will run if the condition is true
```

```
} else {
```

```
    //code that will run if condition is not true
```

```
}
```

```
my_text.font = "Times";
```

modifies the font of your text.

possible fonts: "Arial", "Comic Sans MS", "cursive", "serif", "monospace"

```
my_text.rotation = 75;
```

rotates the text

### Drawing (Doodle Augmented Reality project)

```
var my_drawing = drawing();
```

when drawing is called, you can draw on your video with your cursor

```
my_drawing.color = 'green';
```

modifies the color of your drawing

```
my_drawing.lineWidth = 10;
```

modifies the line width of the drawing

```
my_drawing.x = 0;
```

sets the drawing's position left to right

```
my_drawing.y = 0;
```

sets the drawing's position up to down

### Timing (Newscast project)

```
repeat(function(){
```

```
    //code that repeats
```

```
}, 3);
```

repeats the code inside the function every number of milliseconds (500 in this example)

```
my_repeat.stop();
```

stops repeat from running



## Creative Coding Project Assessment Rubric

STUDENT NAME: \_\_\_\_\_

TOPIC: \_\_\_\_\_ PROJECT TYPE: \_\_\_\_\_

	Unsatisfactory	Competent	Proficient	Distinguished
<b>Video Content</b>	Project does not convey the required information or understanding.	Project shows some understanding of the subject.	Project reflects understanding of the project.	Project reflects understanding and synthesis of the subject.
<b>Code Execution</b>	Program does not work, or has major flaws that prevent its intended use.	Program mostly works, and has only minor flaws.	Program works in the way the student intended.	Program is functional and refined, with extra features that exceed the requirements.
<b>Code Practice</b>	Program is difficult to read. Code contains lines that do not work or are out of order.	Program can be read and is in a logical order.	Program is well organized, easy to read and understand.	Program is well organized, makes good use of white space and comments. Variables have helpful names.
<b>Reflection</b>	Student cannot describe how their code works.	Student can mostly describe how their code works.	Student can describe how their code works and can make changes that have desired effects.	Student can describe how their code works and how they wrote it, and help other debug their code.
<b>Habits of Mind</b>	Student is not aware of the goal of the program, is frequently off task, does not offer their own ideas, and gives up when it is difficult.	Student is aware of the goal of the program, returns to the task when asked, has some ideas when prompted, asks for help when stuck.	Student understands the goal of the program, has their own ideas, rarely goes off task, and attempts to solve problems first before asking for help.	Student embraces the goal of the program and chooses to try out new ideas and multiple solutions, even when they are challenging.
<b>Comments</b>				

Rubric for Assessing Arts in STEM

<b>Does Not Meet Expectations</b> Reflect on next steps	<b>Meets Expectations</b>	<b>Exceeds Expectations</b> Evidence to support
	<p><b>Form</b></p> <p>“What are the parts of a plant?”</p> <p>My animation clearly shows all the primary parts of a plant.</p>	
	<p><b>Change</b></p> <p>“How do plants grow and change?”</p> <p>My animation clearly demonstrates the growth of a plant from a seed.</p>	
	<p><b>Connection</b></p> <p>“How are plants and soils important to the planet?”</p> <p>My animation clearly demonstrates a connection between the seed and soil.</p>	
	<p><b>Approaches to Learning</b></p> <p><b>Communication Skills</b></p> <p><u>Presenting</u></p> <p>My animation was colorful, detailed and clearly showed the stages of growth.</p> <p><b>Research Skills</b></p> <p><u>Observing, Planning</u></p> <p>My planning and drawings were clear and detailed.</p> <p><b>Thinking Skills</b></p> <p><u>Synthesis</u></p> <p>I was able to demonstrate my learning in a clear and coherent way by using my observations and plans.</p>	
	<p><b>Leamer Profile</b></p> <p><i>Communicator</i></p> <p>I clearly communicated the stages of plant growth through my animation.</p> <p><i>Knowledgeable</i></p> <p>My animation clearly showed my knowledge and understanding of the stages of plant growth.</p>	
<p>Overall Reflection:</p>		