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CEP 814

Amazing Animals

Students will learn about how animals receive and respond to a variety of stimuli from the environment. Students will then apply this understanding to create a Scratch project using the "broadcast" feature that sends messages within the code to model an animal in its environment.

Grade: 4th **Subject:** Life Science + Computer Science
Time/Duration: At least 5 lessons, as part of a larger project-based learning unit

Changes from draft to final copy are written in green text. I have left the comments to show the feedback from my colleagues that drove some of the changes.

Rationale
This project connects the idea of broadcasting a message within code with animals receiving stimuli and their brains sending messages for a response. Students will address life science and computer science standards, as well as conducting research to meet writing standards in this project.

Background Knowledge
Students should have some experience using Scratch, or may need more scaffolding / pre-teaching on Scratch before completing this project.

Students will be working in a unit learning about animal adaptations and responses to stimuli. They do not need background knowledge on those topics as they will explore them within the unit.

Resources
- Internet for viewing YouTube videos and researching animals
- Graphic organizers (in lessons below)
    - Digital version or pencil / paper
- Scratch accounts

References
- https://betterlesson.com/lesson/615769/awesome-weird-cool-not?from=cc_lesson
- https://raft.net/lessons/animal-responses-to-information/

Standards

- NGSS (4-LS1-1): Create an explanation showing that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.

- CCSS (W.4.7 and W.4.8): Conduct short research projects that build knowledge through investigation of different aspects of a topic. Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources.

- CSTA (1B-AP-10 for Grades 3-5): Create programs that include sequences, events, loops, and conditionals.

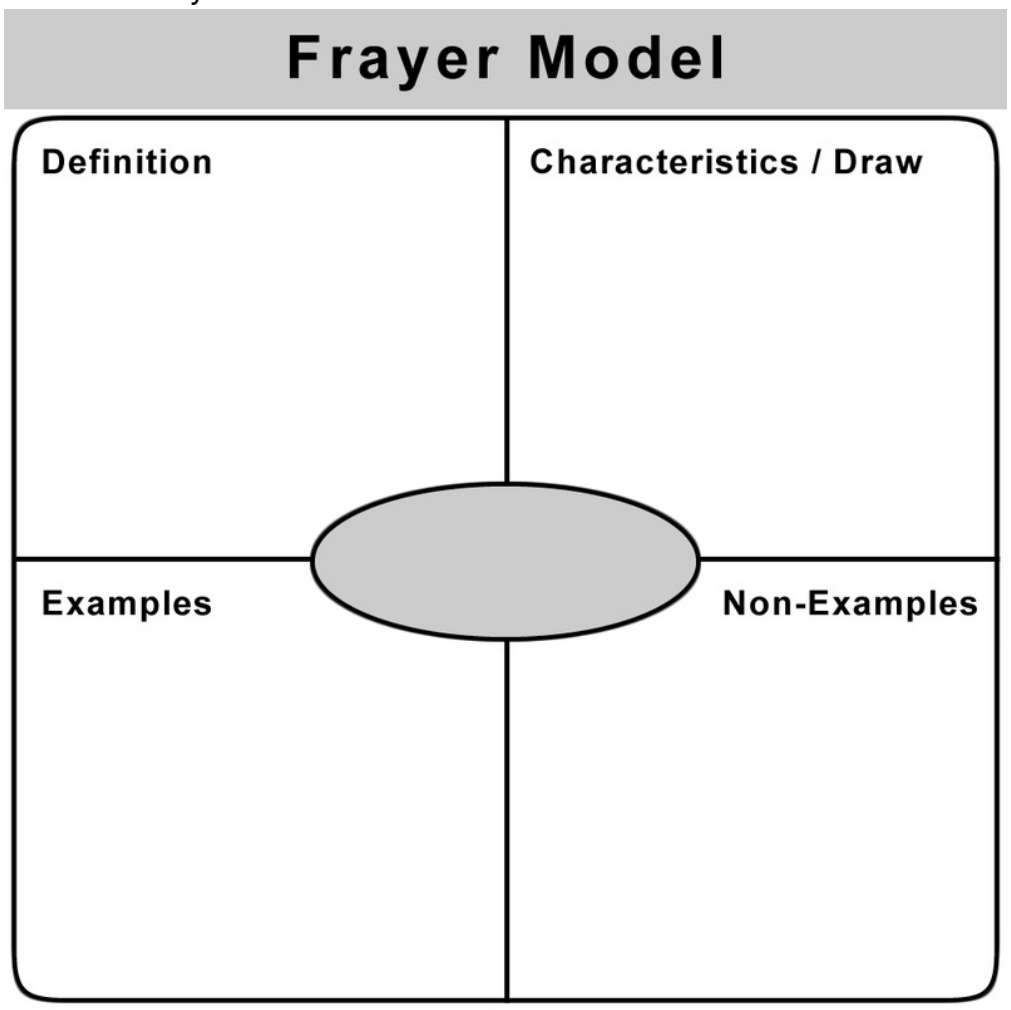
LESSON 1: Descriptive writing + unplugged algorithms

Brain Spark	***Teacher prep for in person learning:*** *Fill brown paper bags with a variety of items with different textures, sizes, etc. (Ex. Peeled grapes, sandpaper, cold piece of metal, rice, small stuffed animal)* ***Teacher prep for virtual learning:*** *Teacher prepares slides with a variety of pictures and videos representing different textures (ex. Velcro, fuzzy animal, leather, grass, etc)* **In person:** Students have a piece of paper and a pencil. They visit each bag and write a word or phrase to describe the feeling of each one. **Virtual learning:** Move through the slides together or asynchronously. Students write down or make notes on a slide of a word or phrase to describe each one.
Direct Instruction	Students return to their list of words and try to come up with a synonym or more descriptive term that appeals to the **senses**. Talk about the five senses of smell, taste, touch, hearing, and sight. Identify that this activity relied on touch, but many animals and humans have other senses, too. (Ex. Replace wet with slimy, cool with metallic) Discuss "showing, not telling" with descriptive writing and the power of using synonyms. Ask students to tell you how to do a simple process, such as brushing teeth or making a peanut butter and jelly sandwich. Ask students what would happen if you did the steps out of order (uncapped your toothpaste after you squeezed the tube or put the peanut butter down before getting out the bread). Discuss the importance of the order of the steps and how that applies to some cases but not others. (Multiplication, for example, can be done in any order: 3 x 5 = 5 x 3) Define **algorithm** as a set list of steps for doing something. Have students brainstorm examples. They may give the example from above, but have them come up with more. Ex. Making a recipe, doing a multiplication problem, driving to school, getting dressed, spelling a word, planting flowers, etc.

Application-Based Activity	Students come up with three categories for how items could feel (ex. Slimy, smooth, gross, sticky, wet, dry, bumpy, etc). They then come up with a reaction to each, too. (Ex. "If it feels slimy, say yuck.") Students write "if, then" statements for each of the three categories and then practice with a partner using them as they reach their hands in once more.
Reflective Practice	Discuss with students that they used another computational thinking skill of **abstraction** today. They looked at the items in the bags or on the slides for one specific feature - the feeling / touch. Even though they could describe them other ways, they had to filter out those other details. Ask students what was easy and challenging about abstracting. **Students fill out a written exit ticket:** Today you used your sense of touch. How do humans use their sense of touch and respond to different feelings?

LESSON 2: It's useful to send messages, Part 1 - Animals

Brain Spark	Have you ever sent a text? An email? A letter through snail mail? A message of some other kind? Tell about a personal connection. Record ideas in a 2-column table for "to" and "from" to connect back to during the instruction. To | From |
Direct Instruction	Ask students what the purpose of sending a message is. Explain, or guide students in explaining, that a message is a way of communicating some piece of information. Animals also receive information through their senses and their brain sends signals to their body so they can respond. Ask students if they've ever seen an example and write down their ideas. Watch this video and / or this video about animal senses. Show students a Frayer model of stimulus with examples and nonexamples. Allow students to write their own definition of the word **stimulus** and share out. Compare definitions and informally assess understanding. Students should define **stimulus** as an event that causes a specific reaction. **Examples:**

	• Touching a hot stove = Say ouch and move your hand away • Dogs hear the doorbell = Barking and running to the door • I am cold = Put on a sweater • Cat is thirsty = Go to the water bowl for a drink **Nonexamples:** • Touching a hot stove = Leaving my hand there • Dogs hear doorbell = Dogs go to get a drink of water • I am hot = Put on a sweater • Cat is thirsty = Go to food bowl to eat
Application-Based Activity	Finish the Frayer model of the word stimulus.  Image source: https://buildingmathematicians.wordpress.com/2016/09/18/how-do-we-meet-the-needs-of-so-many-unique-students-in-a-mixed-ability-classroom/
Reflective Practice	3-2-1 exit ticket (3 things you learned, 2 connections you made, 1 question you have) **Next day:** Compile responses and share out to students common questions. Answer, or have the students answer for each other.

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LESSON 3: It's useful to send messages, Part 2 - Computers

Brain Spark	Last lesson we talked about sending messages. We looked at how animals' senses can send messages to their brains (called stimuli) and how their brains send messages to their bodies to respond. What is an example of an animal receiving and responding to a stimulus? (Student responses may vary.)
Direct Instruction	Today we're going to look at how computers can send messages, too! When we do Scratch projects, we can use a block to "broadcast." This sends a message in your code that can cause other things to happen. It's similar to sending and receiving mail. Some of you made connections to sending and receiving mail in the past lesson!
Application-Based Activity	Share projects for students to look at examples using the broadcast feature. Students record thoughts in this graphic organizer. https://scratch.mit.edu/projects/386828986 I notice… | I wonder… | Discuss as a class: How are broadcasting messages in Scratch similar to animals receiving and responding to stimuli?
Reflective Practice	Students write individual responses: How are broadcasting messages in Scratch similar to animals receiving and responding to stimuli?

LESSON 4: An amazing animal, Part 1 - Research

Brain Spark	Ask students: What's your favorite animal or an animal you're interested in? What makes that animal so interesting / special?
Direct Instruction	Review the vocabulary of algorithm, stimulus, sense, and response. Model researching and taking notes in a graphic organizer.
Application-Based Activity	Students research their chosen animal to identify examples of stimuli, senses used, and animal responses using the graphic organizer below. My chosen animal: Websites / books I used: Stimulus | Sense | Response

Reflective Practice	Students share out one interesting stimulus / response from their animal with the class or with a partner.

LESSON 5: An amazing animal, Part 2 - Scratch project

Brain Spark	Ask students if they have ever used a model of something (doll, stuffed animal, train, etc). Connect how many toys are models and allow students to share personal connections and experiences.
Direct Instruction	Define a **model** as a depiction of a simplified representation of something in real-life that often highlights key features of that thing. Explain that students will be creating a model today. Show an example of a completed Scratch project and provide an explanation of the task. Answer / clarify any student questions. Make a direct connection to algorithms from the unplugged lesson and discuss with students how it will apply to this project. Also make a connection to the broadcast blocks and discuss how they will be a requirement in this Scratch project and ideas to use them.
Application-Based Activity	Students create a Scratch project with the following requirements: **Mild** Animal is represented as a Sprite A message is broadcast Animal Sprite responds to message **Medium** Animal is represented as a Sprite 2 Sprites are used to interact 2-3 messages are broadcast Animal Sprite responds to all messages **Spicy** Animal is represented as a Sprite 2 or more Sprites are used to interact 4 or more messages are broadcast Animal Sprite responds to all messages Backdrop is included that makes sense

<table>
<tr><td></td><td></td></tr>
<tr><td>Reflective Practice</td><td>Students reflect on their learning and explain how their Scratch project demonstrates an animal responding to stimuli. They provide a glow and a grow for themselves, as well as exploring a partner's project and exchanging a glow and grow with them.

<table>
<tr><td colspan="2">My name:</td></tr>
<tr><td>Glow for myself</td><td>Grow for myself</td></tr>
<tr><td></td><td></td></tr>
<tr><td colspan="2">My partner's name:</td></tr>
<tr><td>Glow from my partner</td><td>Grow from my partner</td></tr>
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Final Project Reflection

Which CT ideas are students given the chance to try during this lesson? When in the lesson do they do this?

- Unplugged coding - Initial lesson to introduce project and computation thinking skills
- Abstraction - During unplugged lesson when students only focus on the touch
- Algorithms - During unplugged lesson when students create "if then" statements for the feeling of objects and during Scratch project when students write code for animal responses
- Modeling - Final lesson / Scratch project by creating the animal Sprite who responds to stimuli

Why did you choose to focus on these CT ideas?

I chose to focus on these as they are developmentally appropriate for upper elementary students when scaffolded. Students in fourth grade already use algorithms often. They just need the definition with concrete examples and projects to make a connection to computational thinking. They also were a logical fit and did not feel forced to align with the NGSS standard I will be teaching during the lesson. I firmly believe that technology should enhance and transform activities and never feel like the activity was only designed to use the technology. If the technology doesn't help reach the learning goal, it is not useful. In this case, the broadcast blocks directly correlate to the stimulus and response in life science.

What was challenging about trying to address both CT ideas and other content (e.g., math or ELA)? How did you think about balancing these two aims?)

I had to find meaningful connections between the life science standard and computer science standard. I think the engineering standards and physical science standards are often quite easy to connect to, but life science can feel very "natural." Animating animals was a good balance because it helped to model the natural world but could preserve the natural interactions the animals would have. Computers also give us a great power to research the natural world we couldn't necessarily show our students (I don't have many elephants in Mississippi!). Technology should enhance a lesson, not make it awkward or feeling inauthentic. I also wanted to use more than one computational thinking skill in order to help students make connections between computational thinking and science as well as across computational thinking skills themselves. I wanted them to consider how we can use algorithms in a model about life science. Life doesn't separate itself into "subjects" like we do in school!

Imagine implementing this lesson in your classroom (or actually do it, if you want to!). What challenges might come up? What kind of barriers might there be? What additional supports might you need?

My students don't have any experience with using coding such as Scratch. They'll need some introduction and scaffolding before they're ready to dive in. They also struggle with researching when given the whole world wide web, so providing some reliable resources and / or some lessons on choosing reliable resources will be helpful. On the other hand, they have done a fantastic job simply diving in to new technology tools and project ideas we have done. We also are completely virtual (I teach from Mississippi. I have one student in Michigan and one student in Florida.) so it is hard to work one-on-one without being able to share a computer screen / mouse. Breakout rooms and screen sharing will be my friend! I do work in the private school setting with only two students, so I am afforded a lot of opportunities working virtually with my students that I am grateful for. I can set up additional times with students when I need to support them one-on-one and I can expect parents to support me with certain activities and purchasing materials. This doesn't mean I don't have challenges, but my situation is very unique at the moment.