ARIZONA SCIENCE CENTER
Never stop wondering.
Never stop imagining.

Lions, Tigers & Monsters, Oh My!

Week 4: Grades 6-8

Day	Topics	Related Standards
1	A Monsterous Task!	Develop and use a model to explain how natural selection may lead to increases and decreases of specific traits in populations over time.
2	It's Dinner Time!	
3	Monsters in Love	Construct an explanation of how genetic variations occur in offspring through the inheritance of traits or through mutations.
4	Family of Monsters	
5	Ladies & Gentlemen, I Present to You...	

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Day 1: A Monsterous Task!

Teacher/Parent Background:

Lions, tigers and monsters? Yes, you read that correctly; monsters! By creating a unique monster to survive in a specific environment, students will apply their understanding of adaptations. All animals and plants (including monsters!) have specific structures and behaviors that help them survive in their environments.

Overview:

In this activity, students will begin to imagine their unique monster by brainstorming the structures it possesses that help it to survive in an ecosystem of their choosing.

Related Standards:

- Develop and use a model to explain how natural selection may lead to increases and decreases of specific traits in populations over time.

Key Terms:

- Structural Adaptation: physical feature of an organism that help it to survive in its environment.
- Behavioral Adaptation: things organisms do to help them survive in their environments.
- Biotic: Living things
- Abiotic: Non-living things

Materials List:

- Pen/pencil
- Possible visual representation resources:
    - Colored pencils/crayons/markers
    - Internet access for images/pictures
    - Internet access - optional for *Extensions*
- *Student Resources*

Activity Description:

1. Introduce students to the project details.

a. Inform students that they will have time on Day 5 to build a 3D model of their monster, as they may make changes to their monster throughout the week.

2. To help remind students about adaptations they will observe images of animal tracks in different environments and complete the Animal Track Adaptation chart and answer the questions.

Animal Tracks			
			
What does it do? (climb, grab, swim, jump, run)	**What does it do? (climb, grab, swim, jump, run)**	**What does it do? (climb, grab, swim, jump, run)**	**What does it do? (climb, grab, swim, jump, run)**
(Bear Tracks) climb, grab, run	(Duck Tracks) swim	(Deer Tracks) run, jump	(Bird Tracks) climbing, grabbing, running
What environment do you think it is best adapted for?	**What environment do you think it is best adapted for?**	**What environment do you think it is best adapted for?**	**What environment do you think it is best adapted for?**
Woods, grassy areas, mountains	Ponds, lakes. swamps	Wooded areas, fields	Rocky areas, wooded areas with trees

4. Guide students to choose an environment that they would like their monster to live in and the kinds of adaptations their monster needs to survive in their chosen environment.

5. Ask students to draw a detailed picture of their monster with adaptations labeled and environment described.

Closure:

- After the activity has concluded, engage in a discussion with students:
  - How would you best describe your monster?
  - What about your monster's structures help it survive?
  - What else might we need to know about your monster, as the project continues?

Extensions:

Continue the Project!

- Encourage students to research (example source 1 & example source 2) animal behaviorists or zoologists to learn more about what they do. For example, ask students to research:
  - What does an animal behaviorist/zoologist do?
  - What kind of training do they need?
  - What carrer opportunities do they have?

Student Resources

Monster Project Details

Dear Student,

As a local animal behaviorist, my team and I are interested in working with you to learn more about your newly discovered monster! My sources have informed me that you are currently in the process of identifying and observing this new creature. You have been tasked with presenting your findings to my team as soon as possible, so that we may study this monster as well. Please closely follow all the project details outlined below:

1. **Your project report must include a description and visual representation of the following:**
    a. The monster's physical and behavioral adaptations.
    b. The monster's ecosystem.
    c. The monster's feeding relationships, including what/how it eats and what eats it.
    d. The monster's offspring and family.

2. **You may use the following resources to create visual representations:**
    a. Drawings
    b. Pictures/videos
    c. 3D models (this is our preferred method of studying!)

3. **In addition to the project portfolio, you must prepare a presentation:**
    a. Explain each part of the portfolio to a family member, friend, teacher, etc. Walk someone through your findings!
    b. The presentation can take place through one of the following ways:
        i. Face-to-face
        ii. Video conferencing/recording

My team eagerly awaits your report. Best of luck out there!

Dr. Lilly Padton

Animal Track Adaptations

1. Observe the animal tracks and use your observations to complete the chart below.

Animal Tracks			
			
What does it do? (climb, grab, swim, jump, run)	**What does it do? (climb, grab, swim, jump, run)**	**What does it do? (climb, grab, swim, jump, run)**	**What does it do? (climb, grab, swim, jump, run)**
What environment do you think it is best adapted for?	**What environment do you think it is best adapted for?**	**What environment do you think it is best adapted for?**	**What environment do you think it is best adapted for?**

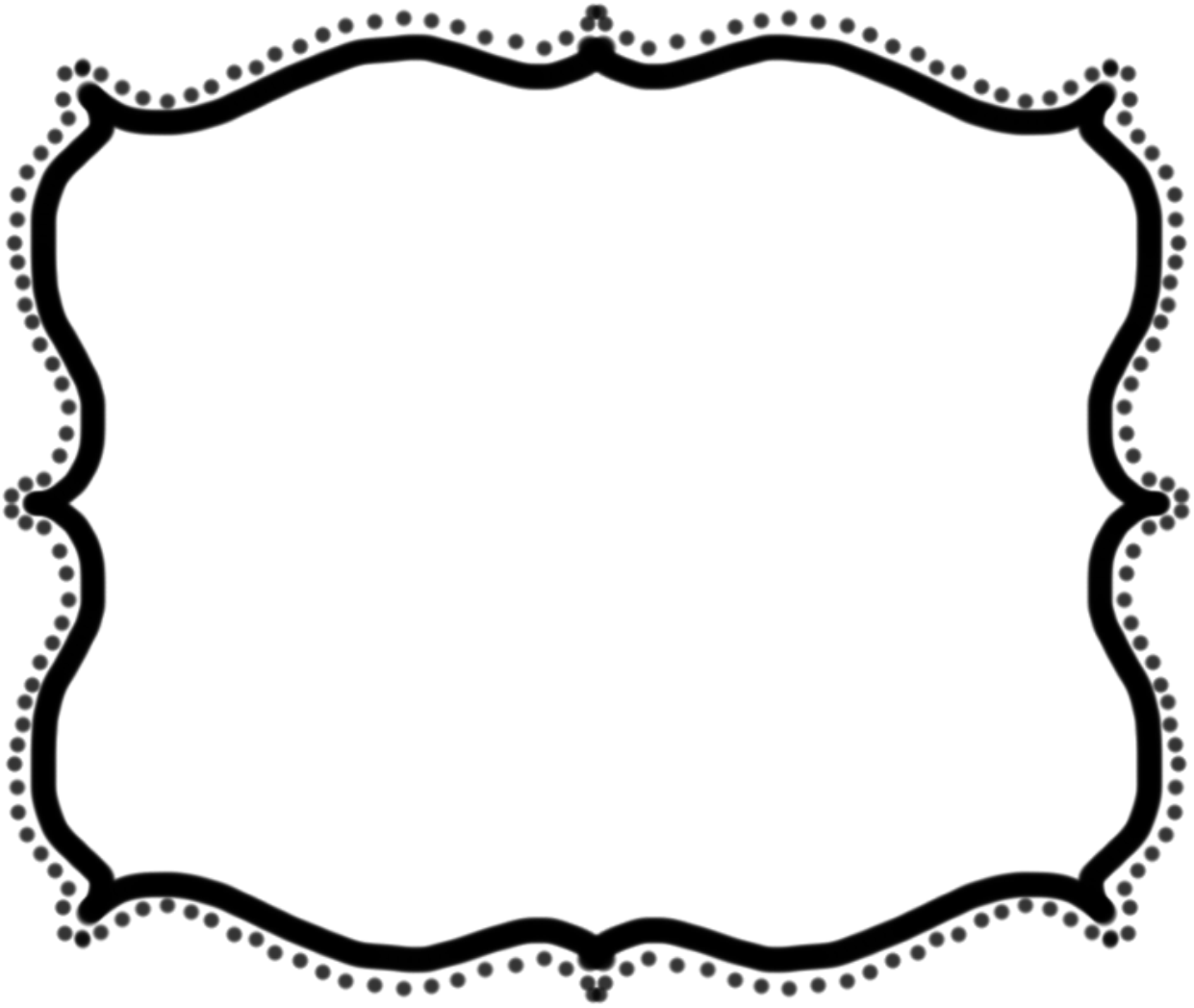
Think about the monster you are going to create and the environment in which it lives.

How is your monster adapted to

1. It's environment:
    a. Behavioral Adaptation:
    b. Structural Adaptation:
2. Eating
    a. What does it eat:
    b. How does it eat:

3. Avoid Predators:
    a. Behavioral/Structural Adaptation:
4. Moving Around:

My Monster's Portrait



Monster Brainstorming!
Describe the environment in which your monster lives (temperature, biotic and abiotic factors, rainfall, etc.)
Label and describe the adaptations your monster has to help it survive in your chosen environment.

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Day 2: It's Dinner Time!

Teacher/Parent Background:

Lions, tigers and monsters? Yes, you read that correctly; monsters! By creating a unique monster, students will apply their understanding of the needs of living things and their roles in their environments. All animals and plants (including monsters!) have internal structures and external structures that help them survive, grow and behave in their environments. Living things need ways/strategies to obtain the energy they need to survive in their environments. Some living things, called consumers, directly consume other living things for food. Other living things, called producers, produce their own food using sunlight, water and gases in the surrounding air. In science, we describe the possible path energy can take through an ecosystem, between one living thing to the next, as a food chain.

Overview:

In this activity, students will create a food chain to show the feeding relationships between their monster and other living things in their ecosystems.

Related Standards:

- Develop and use a model to explain how natural selection may lead to increases and decreases of specific traits in populations over time.

Key Terms:

- Producers: living things that make their own food.
- Consumers: living things that eat other living things for food.
- Food Web: an interconnected set of food chains.
- Carnivore: an organism that eats other animals.
- Herbivore: an organism that eats plants.

Materials List:

- Pen/pencil
- Possible visual representation resources:
    - Colored pencils/crayons/markers
    - Internet access for images/pictures
- Internet access - optional for *Extensions*
- Computer/phone with audio - optional for *Extensions*

- *Student Resources*

Activity Description:

- As we continue this project, we still need to know a few things about your monster! One of which is how your monster gets the energy it needs to survive and grow. Just like us, some living things called *consumers*, eat other living things for food.
    - For example:
        - A wolf eats a deer to get the energy it needs.
- Other living things call *producers*, make their own food using resources in its environment, like sunlight and water.
    - For example:
        - Plants, trees and bushes make their own food to get the energy they need.
- In science, we organize these feeding relationships using a food chain. A *food chain* shows a path energy can take through an ecosystem, from one living thing to the next.
- Today, you are going to create your monster's food web by answering the following questions:
    - What does your monster eat in its ecosystem?
    - How does it eat? What structures help it eat?
    - What eats your monster in its ecosystem?
    - How does that living thing eat? What structures help it eat?
- To help you get started, we are going to explore an example of a food chain!
    - Engage students as they follow the instructions in the student handout.
        - Encourage students to use colored pencils/crayons/markers to help them illustrate the food chain and food web.

Closure:

- After the activity has concluded, engage in a discussion with students:
    - How would you describe your monster's food chain?
    - Now that you have created your monster's food chain, what changes do you want to make to your monster/monster's structures to make sure it is best suited to live in its ecosystem? Are there any changes you want to make to your ecosystem's living things?
        - Feel free to update your *Monster' s Portrait* from Day 1 and your *Monster's Ecosystem* from Day 2!

Extensions:

Watch! Crash Course Kids - *Fabulous Food Chains* & *Food Webs*

Student Resources

1.Think about the environment your monster lives in

2. Brainstorm the different organisms that live in your monster's habitat (your organisms can be real or imaginary monsters, as well).

3. Record your ideas by writing/drawing the organisms under the correct categories below.

Producers
Consumers

4. Circle all the carnivores and draw a square around all of the herbivores in the table above.

5. Draw a simple food chain of organisms found in your habitat beginning with the Sun. Be sure to include the main source of energy in your chain.

Food Chain

5. Create a food web of organisms in your habitat. Be sure to show how energy flows (using arrows) from the Sun through the different food chains in the food web.

Food Web

- Be sure to include names and drawings of the living things and your monster.
- Don't forget to include arrows to show the path of energy!

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Day 3: Monsters in Love

Teacher/Parent Background:

Lions, tigers and monsters? Yes, you read that correctly; monsters! By creating a unique monster, students will apply their understanding of the needs of living things and their roles in their environments. All animals and plants (including monsters!) have adaptations that help them survive, grow and behave in their environments. Scientists define survival as not only the ability to live and grow but also to successfully reproduce.

Overview:

In this activity, students will create their monster's mate to develop an understanding of genotypes and phenotypes.

Related Standards:

- Construct an explanation of how genetic variations occur in offspring through the inheritance of traits or through mutations.

Key Terms:

- Species: a group of organisms with similar characteristics that allow them to reproduce.
- Trait: a distinct characteristic of an organism.
- Gene: the basic physical and functional unit of heredity made up of DNA.
- Allele: different versions of a gene.
- Genotype: the exact genetic information carried by a single individual.
- Dominant Trait: an allele that is always expressed.
- Recessive Trait: an allele that is only expressed if there is no different allele present.

Materials List:

- Pen/pencil
- Possible visual representation resources:
    - Colored pencils/crayons/markers

Activity Description:

1. Give students this Introduction to Genetics to either review or use as reference when completing the student resources.

Closure:

Discuss the following with students:

Describe the relationship between the monster's genotypes and their phenotypes.

Extensions:

STEAM Activity! Watch the science music video and have students come up with their own song using the vocab terms in this lesson. - *Girl, your phenotype is showing.*

Student Resources

Even monsters can fall in love. In this activity you are going to build a mate for your monster!

1. Determine the dominant and recessive traits of four key physical characteristics of your monster and then assign them a random letter. A capital letter will signify the dominant trait and a lowercase letter will signify the recessive trait. Reference the example below:

Dominant Trait	Assigned Letter	Recessive Trait	Assigned Letter
One Eye	E	Two Eyes	e
Two Horns	H	One Horn	h
Yellow Horns	Y	Orange Horns	y
Sharp Teeth	T	Round Teeth	t

If my monster is the monster on the right than his genotype is as follows:

ee, Hh*, YY*, tt

*There are 2 ways for a dominant trait to be expressed, you may randomly choose your monster's genotype if a dominant trait is expressed.

2. Draw a picture of your monster from day 2, below.

Picture of Your Monster

Dominant Trait	Assigned Letter	Recessive Trait	Assigned Letter

Your monster's genotypes:

__ __, __ __, __ __, __ __

3. Now build your monster's mate! You can make the monster's mate look however you'd like, as long as it has the four characteristics from your table above. In my example from #1, my monster's mate must have 1 or 2 horn(s), orange or green horn(s), 1 or 2 eye(s), and round or sharp teeth. Here is my example mate and it's genotypes:

Ee, Hh, yy, TT

4. Draw a picture of what you want your monster's mate to look like below.

Picture of Monster Mate

Mate's Genotypes (using the chart from #2 above):

__ __, __ __, __ __, __ __

Lions, Tigers & Monsters, Oh My!

Day 4: A Family of Monsters

Teacher/Parent Background:

Lions, tigers and monsters? Yes, you read that correctly; monsters! By creating a unique monster, students will apply their understanding of the needs of living things and their roles in their environments. All animals and plants (including monsters!) have adaptations that help them survive, grow and behave in their environments. Scientists define survival as not only the ability to live and grow but also to successfully reproduce.

Overview:

In this activity, students will create their monster's offspring using punnett squares.

Related Standards:

- Construct an explanation of how genetic variations occur in offspring through the inheritance of traits or through mutations.

Key Terms:

- Punnett Square: A tool used to analyze the possible allele combinations of the offspring between 2 individuals.
- Heredity: The transfer of genetic information from parent to offspring.

Materials List:

- Pen/pencil
- Possible visual representation resources:
    - Colored pencils/crayons/markers
    - Internet access
    - *Student Resources*

Activity Description:

- Have students review punnett squares using this reading and this video before following the instructions on the Student Resources page.

Extensions:

Watch! TED Ed - *How Mendel's Pea Plants Helped Us Understand Genetics*

Student Resources

Even monsters can fall in love. In this activity you are going to predict the probability your monster's offspring will be born with a certain trait!

1. Refer back to your monster and their mate from day 3. In this first step you will write out the monster's genotypes and phenotypes out. Use the example below as a guide.

Dominant Trait	Assigned Letter	Recessive Trait	Assigned Letter
One Eye	E	Two Eyes	e
Two Horns	H	One Horn	h
Yellow Horns	Y	Orange Horns	y
Sharp Teeth	T	Round Teeth	t

Monster 1	Monster 2
	
Genotype: ee Phenotype: 2 eyes	Genotype: Ee Phenotype: 1 eye
Genotype: Hh Phenotype: 2 horns	Genotype: Hh Phenotype: 2 horns
Genotype: YY Phenotype: Yellow horns	Genotype: yy Phenotype: Orange horns
Genotype: tt Phenotype: Round teeth	Genotype: TT Phenotype: Sharp teeth

2. Next, you will determine the probability that the monster's offspring will inherit their parent's traits using punnett square. Use the example below as a guide.

Trait 1: # of eyes		
	e	**e**
E	Ee	Ee
e	ee	ee

3. Once you have all the punnett squares complete you assign each genotype a color and pick colored squares out of a hat or a bag to get the true sense of chance that plays into inheritance. For example all genotypes with 2 dominant alleles (EE) will be assigned red, genotypes with 2 different alleles (Ee) will be assigned blue and genotypes with 2 recessive alleles will be assigned yellow. You can either cut out the colored squares from the bottom of the student resource page or make your own.
4. In the example above you would place 2 blue colored squares and 2 yellow colored squares in a hat and randomly choose one without looking. Whatever colored square you pick is the genotype of your monster's offspring!
5. Once all the traits have been chosen, draw the monster's offspring on the last page.

1.

Your Monster	Monster's Mate
Genotype: Phenotype:	Genotype: Phenotype:
Genotype: Phenotype:	Genotype: Phenotype:
Genotype: Phenotype:	Genotype: Phenotype:
Genotype: Phenotype:	Genotype: Phenotype:

Trait 1:		

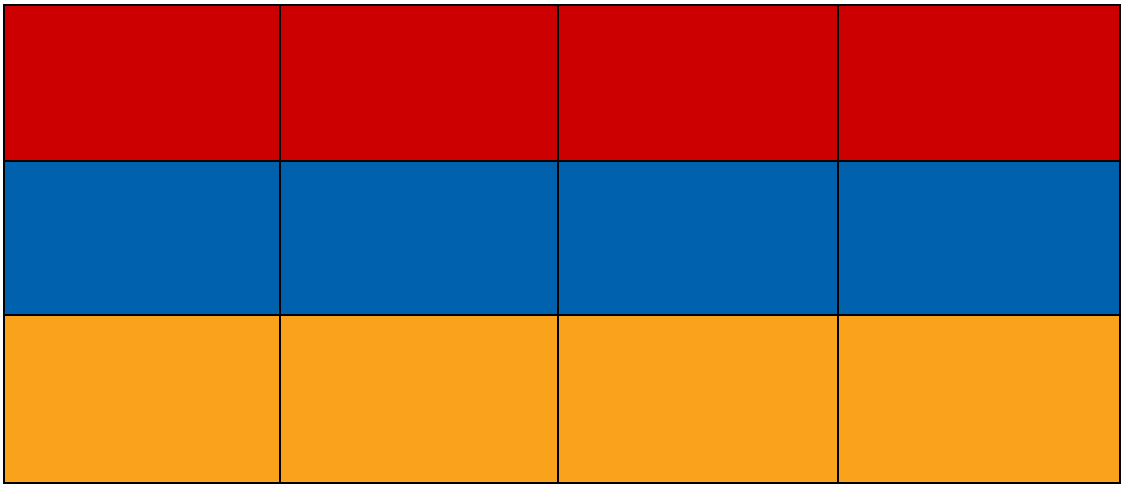
Trait 2:		

Trait 3:		

Trait 4:		

2. Write the offspring's genotypes and phenotypes for each of the 4 traits below after randomly selecting the colored squares from a hat. Then draw your offspring below.

Monster Offspring	
Trait 1: Genotype: Phenotype:	Trait 3: Genotype: Phenotype:
Trait 2: Genotype: Phenotype:	Trait 4: Genotype: Phenotype:
Picture of offspring:	



Lions, Tigers & Monsters, Oh My!

Day 5: Ladies & Gentlemen, I Present to You…

Teacher/Parent Background:

Lions, tigers and monsters? Yes, you read that correctly; monsters! By creating a unique monster to survive in a specific environment, students will apply their understanding of adaptations. In the science community, scientists and engineers communicate their findings with others to share their work and receive feedback. Just like scientists and engineers, students will also prepare a brief presentation of their monster projects' findings to share with others.

Overview:

In this activity, students will present their monster projects' findings with others.

Related Standards:

- Construct an explanation of how genetic variations occur in offspring through the inheritance of traits or through mutations.

Materials List:

- Pen/pencil
- Possible materials for 3D model:
    - Popsicle sticks
    - Clay/Playdough
    - Feathers/fabric
    - Cardboard/wood
    - Construction paper
    - Aluminum foil
    - Markers
    - Glue/tape and scissors
- Possible video conferencing/recording resources:
    - *Google Hangouts*
    - *Zoom*
    - *iMovie*
    - *Flipgrid*
    - Record a video and email it to a friend or teacher
    - FaceTime

Activity Description:

- Revisit student ideas from *Day 4's: A Family of Monsters.*
    - Now that you have created your monster's offspring, did you make changes to your monster's structures, ecosystem or food chain/web, to make sure it is best suited to survive in its environment? Why or why not?
- So far, we have learned so much about your monster, including its:
    - structural and behavioral adaptations
    - environment
    - food chain and food web
    - genetics and offspring
- As we near the end of this project, we still need to complete one more task...the presentation! Let's revisit the *Monster Project Details* to check our progress so far and to recall details of the presentation.
    - Review the *Monster Project Details* with students.
    - Assist students in checking their progress to ensure they have completed all details listed under Step 1 and 2.
        - **Note:** Students will have time during this activity to build a 3D model of their monster.
    - Encourage students to ask questions about the project details.
- Today, you are going to prepare a brief presentation of your monster project to share with others! You will need to walk someone else through your findings, using and sharing your portfolio pages and model.
    - Looking back through the project details, it seems like Dr. Lilly Padton's team would be interested in studying a 3D model of your monster. This would make a great addition to your presentation, helping your drawings/pictures come alive!
        - Encourage students to use simple, household materials to create a model of their monster. Some may include:
            - Popsicle sticks
            - Clay/Playdough
            - Feathers/fabric
            - Cardboard/wood
            - Construction paper
            - Aluminum foil
            - Markers
            - Glue/tape and scissors
        - Assist students as they begin creating a 3D model of their monster family portrait.
- Now that our monster models are completed, you will present your portfolio pages and model with someone else! Scientists and engineers not only communicate their findings with others, but they also ask for feedback. Ask your audience for feedback, asking questions like:
    - What do you like?

- What do you have questions about?
- What would you change or do differently? Why?
    - Assist students in choosing an audience to share their project with. This may include a family member, friend or teacher.
    - Students may decide to present face-to-face with a family member or use video recordings/conferencing options. Some examples include:
        - Google Hangouts
        - Zoom
        - iMovie
        - Flipgrid
        - Record a video and email it to a family member, friend or teacher
        - FaceTime

Closure:

- After the activity has concluded, engage in a discussion with students:
    - What did you enjoy the most about this project? What did you find the most challenging and why? What helped you overcome the challenge?
    - What was your audience's feedback from the presentation? What did you learn from their feedback?
    - What advice would you give to someone starting the same project?
    - How does your work and skills you used throughout the project relate to the work and skills of scientists and engineers?

Extensions:

<u>Continue the Project!</u>

- Encourage students to make revisions to their projects based on feedback they received from audience members.
    - Prompt students to make changes to their portfolio pages/model.
- Encourage students to formalize their presentation using tools such as:
    - Google Slides
    - Microsoft PowerPoint
    - Posters/chart paper
- Then, prompt students to re-present to their audience, sharing their improvements and asking for additional feedback.