Endeavor
STEM Teaching Certificate Project

Design an Animal

Grade 4

Science, Technology, Engineering, ELA, and Art

Christine Hoskins, Superior, Colorado

BIG IDEAS

STEM Conceptual Ideas Related to the Animal Adaptation Project

1. **Systems Thinking:**
   - Understanding the ecosystem as a system where various species, including the designed animal, interact with their environment and each other. Students will explore how adaptations influence survival and the balance within the habitat.
2. **Innovation and Design:**
   - Students will engage in the engineering design process by creating their unique animal, considering how its adaptations solve specific challenges in its habitat. This includes brainstorming, prototyping, and iterating on their designs.
3. **Problem-Solving:**
   - Identifying challenges that animals face in their assigned habitats (e.g., food scarcity, climate, predators) and devising specific adaptations that enable their designed animal to overcome these challenges.
4. **Data Analysis:**
   - Researching real-world animals and their adaptations in similar habitats. Students will analyze how these adaptations help actual animals survive, using data to inform their designs and justify their choices.
5. **Engineering Principles:**
   - Applying concepts of structural and behavioral adaptations in their animal design. For example, students will consider how the animal's body structure (like limbs or camouflage) and behaviors (like hunting or migration) contribute to its survival.

6. **Scientific Inquiry:**
   - Encouraging students to ask questions about adaptations and conduct research to find answers. They will hypothesize how certain adaptations might work in their designed animal and then validate these hypotheses through their project.
7. **Collaboration and Communication:**
   - Working in pairs or small groups fosters teamwork as students share ideas, provide feedback on each other's designs, and collaborate on the website creation to communicate their findings and designs effectively.
8. **Adaptation and Resilience:**
   - Understanding how organisms adapt to their environments and the importance of resilience in survival. Students will explore how their designed animal can adapt to changes in the habitat over time.
9. **Interdisciplinary Connections:**
   - Integrating knowledge from biology (animal behavior and habitats), technology (website creation), and art (designing the animal) to create a comprehensive project that showcases their learning across disciplines.

EDUCATION STANDARDS

- **Next Generation Science Standards (NGSS):**
  - 4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

NGSS Performance Expectation(s)

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts:
Developing and Using Models Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions. ♣ Develop a model to describe phenomena. (4-PS4-2) ♣ Use	**LS1.A: Structure and Function** ♣ Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. (4-LS1-1)	**Systems and System Models** ♣ A system can be described in terms of its components and their interactions. (4- LS1-1), (LS1-2)

a model to test interactions concerning the functioning of a natural system. (4-LS1-2)		

Common Core State Standards:

- ELA: **Common Core State Standards for English Language Arts (CCSS ELA):**
  - W.4.2. Write informative/explanatory texts to examine a topic and convey ideas and information clearly.
  - SL.4.4. Report on a topic or text, tell a story, or recount an experience in an organized manner, using appropriate facts and relevant, descriptive details to support main ideas or themes.

ITEEA Standards

- **International Technology and Engineering Educators Association (ITEEA) Standards:**
  - **Standard 5:** Design. Students will develop an understanding of the characteristics and scope of technology.
  - **Standard 7:** Analyze the characteristics and scope of technology. Students will analyze the impact of technology on the environment and society.
  - **Standard 8:** The influence of technology on the environment and society. Students will evaluate the effects of technology on the environment and society.

- **National Core Arts Standards (NCAS):**
  - **Creating:**
    - VA:Cr1.1.4a Generate and conceptualize artistic ideas and work.
    - VA:Cr2.1.4a Organize and develop artistic ideas and work.
  - **Presenting:**
    - VA:Pr4.1.4a Select, analyze, and interpret artistic work for presentation.
    - VA:Pr5.1.4a Develop and refine artistic techniques and work for presentation

MEASURABLE STUDENT LEARNING OBJECTIVES

1. **Research Skills:** Students will accurately identify and describe at least three challenges faced by animals in their assigned habitat.
   - *Measurement:* Students' notes and participation in discussions will be collected and assessed for completeness and accuracy.
2. **Understanding of Adaptations:** Students will create an animal design that includes at least six different structural and behavioral adaptations, demonstrating a clear understanding of how each adaptation helps the animal survive in its habitat.
   - *Measurement:* The animal design and website page will be evaluated using the Design an Animal Rubric.
3. **Creative Expression:** Students will create a visually appealing website page that includes a habitat description, images, and labels for their animal's adaptations, demonstrating effective use of technology and creativity.
   - *Measurement:* The website will be assessed for layout, organization, and the integration of text and images based on the rubric.
4. **Presentation Skills:** Students will effectively present their animal design and adaptations via a website, using appropriate facts and descriptive details to support their main ideas.
   - *Measurement:* Peer and teacher feedback during presentations will be used to assess clarity, engagement, and organization.
     Design an Animal Rubric.

STEM INTEGRATION

The integration of science, technology, and art allows students to engage with concepts in a holistic manner, enhancing their understanding. This interdisciplinary approach encourages the application of learning across subjects, fostering creativity, critical thinking, and problem-solving skills.

Science:

- **Concepts Explored:** Students will explore habitats and determine how weather, landscape, and predators impact survival. Students will study animal adaptations, including structural and behavioral traits that enable survival in various habitats.
- **Practices Developed:** Scientific inquiry practices will be utilized as students research real animals, formulate hypotheses about their adaptations, and analyze their findings to develop a deeper understanding of ecological systems.
- **Understanding Enhancement:** By applying scientific concepts to their animal designs, students gain a practical understanding of how adaptations impact survival.

Technology:

- **Concepts Explored:** Students will utilize technology to create websites that showcase their designed animals and their adaptations. This involves researching, using design software, and presenting information digitally.
- **Practices Developed:** Technological skills will be developed as students learn to navigate online research tools, create their websites, and utilize Google Drawing and possibly Adobe Express AI. They will also learn about effective communication through technology.
- **Understanding Enhancement:** The use of technology allows students to communicate scientific concepts in a creative, engaging, and effective way.

Art:

- **Concepts Explored:** Students represent their designed animal through drawing, painting, or 3-D model (clay or paper mâché). Students will share their creation on their website, labeling adaptations they developed.
- **Practices Developed:** Artistic skills will be cultivated as students engage in drawing, modeling, and digital design. Students will share their ideas visually, which is crucial for effective communication in both science and technology.
- **Understanding Enhancement:** Art promotes the expression of understanding in a creative way By designing an animal, students can visualize adaptations and their functions, making abstract scientific concepts more concrete and accessible.

The integration of science, technology, and art provides a comprehensive learning experience that enhances students' understanding across all subjects. Students will see how scientific research will lead to innovation and improvements through artistic design. By engaging in research, critical thinking, artistic representation, and digital design, students develop essential problem-solving skills and knowledge that will prepare them for future academic and career pursuits. This interdisciplinary approach not only deepens their understanding but also fosters a love for learning and exploration.

NATURE OF STEM

The Design an Animal Project embodies the nature of science, technology, engineering, and mathematics (STEM) by incorporating essential principles and practices that reflect how these disciplines function in the real world. Here's how each aspect is addressed:

Nature of Science:

This project emphasizes scientific inquiry as students explore habitats, structural adaptations, and behavioral adaptations through research and analysis. Students mirror the scientific method as they develop hypotheses about how certain adaptations help animals survive in their habitats. Through research and the design of their animals, they will deepen their understanding of ecosystems.

Nature of Technology:

The use of technology for creating engaging websites represents how web-based tools enhance communication and presentation in the digital age. Students learn to utilize digital resources for research and to present their findings effectively. Creativity and innovation through technology address real-world challenges.

Nature of Engineering:

The project incorporates engineering design principles as students design their animals, requiring them to think critically about structural adaptations necessary for survival. The design process mirrors engineering practices, including brainstorming, prototyping, testing, and refining ideas. Through an iterative process, students will consider how their designed animal will function in their habitat.

Interdisciplinary Approach: The lesson highlights the interconnected nature of STEM fields, demonstrating that real-world problems often require knowledge and skills from multiple disciplines. By integrating science, technology, engineering, and mathematics, students gain a holistic understanding of how these fields work together to address challenges. Students are able to build their skills in critical thinking, creativity, and problem-solving skills to better prepare them for learning.

MATERIALS NEEDED

- Spinning wheel or spinner (for habitats and classes)
- Research materials (books, articles, internet access)
- Art supplies (paper, colored pencils, modeling clay, etc.)
- Computers/tablets for website creation

ENGAGING CONTEXT/PHENOMENON

Begin the lesson by presenting *Our World: Snowpits* to showcase how animals adapt to extremely cold environments in extraordinary ways. After the video, pose the following question to the

students:

"If you could design a brand new animal to survive in your favorite habitat, what would it look like, and what special features would it have to help it thrive?"

Encourage students to think creatively about the adaptations their animal might need, such as camouflage, special limbs, or unique behaviors. This will spark their imaginations and set the stage for the design activity ahead!

DATA INTEGRATION

While data doesn't really fit the scope of this work, showing students this video would be interesting. High fliers might explore a bit deeper with the tools discussed in the video.

TEACHER BACKGROUND KNOWLEDGE

Teachers need to understand that habitats differ throughout the world. The assumption is that some geography work has been done with students prior to this unit so they have sufficient background knowledge.

Further, educators must be able to draw connections from habitats to animal adaptations for each classification of animal.

DIFFERENTIATION OF INSTRUCTION

Students will be expected to spin a wheel to be assigned a habitat and animal class. For those students who need more support, they can self-select or be encouraged to choose both a habitat and animal class that will provide the easiest access to research. Conversely, students who need a challenge could be asked to create a reptile adapted to live in Antarctica. Extensions can also be provided for those students as they can explore NASA data related to migration, as discussed above.

Teachers can also scaffold by providing research for students, sentence stems for the written portion of the website, and the possibility of working with a partner.

REAL-WORLD CONNECTIONS FOR STUDENTS

To begin our discussion of adaptations, discuss how we pack for cold vs. warm climates to help us adapt to our new environments when vacationing.

Have students share animal adaptations for each biome.

INTEGRATION POSSIBLE MISCONCEPTIONS

Students may have a difficult time discriminating between structural and behavioral adaptations so watching animal adaptation videos followed by discussion would be helpful.

LESSON PROCEDURE

5E	Details of 5E Lesson Implementation
Engage	**Procedure:** Begin the lesson by presenting *Our World: Snowpits* to showcase how animals adapt to extremely cold environments in extraordinary ways. After the video, pose the following question to the students: *"If you could design a brand new animal to survive in your favorite habitat, what would it look like, and what special features would it have to help it thrive?"* Encourage students to think creatively about the adaptations their animal might need, such as camouflage, special limbs, or unique behaviors. This will spark their imaginations and set the stage for the design activity ahead! Explain that there are two types of adaptations: structural and behavioral. Discuss both types then show a video with both types. Give students the following note catcher to complete as they watch the video. Have students partner share examples of both they saw in the video. Add *structural* and *behavioral adaptation* to vocabulary in science journals. **Modifications** • Provide printed definitions that can be pasted into science notebooks for students who need it • Provide completed note catcher for students who need it • Provide sentence stems for the discussion • Thoughtful pairings for partner work **Standards Addressed** 4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

	Formative/Summative Assessments Completed note catcher and discussion participation **Resources** *Our World: Snowpits* Weird Animal Adaptations Note catcher
Explore	**Procedure:** **Day 1** - Students will spin for a habitat and animal class. Then, individually or in pairs, students will research the habitat they landed on. Questions they might consider are as follows: • What does the environment look like? • What is the weather like? Does the habitat have seasons? • What kind of food is available to animals? • What are possible predators in this habitat? • How does the habitat change during the day and night? • Are there other dangers in this habitat? Provide resources such as books, articles, and safe internet sites for research. Have students take notes on key features of the habitat and potential adaptations needed for survival. They will then use this Website Note catcher to write the habitat portion of their website. **Modifications** Some students might benefit from working with a partner to complete the project. Specific resources can be provided to ease the search. Using Newsela, leveled Lexile texts can be accessed. Voice to text is also an option for the written portion **Standards Addressed** • ELA: **Common Core State Standards for English Language Arts (CCSS ELA):** ○ W.4.2. Write informative/explanatory texts to examine a

	topic and convey ideas and information clearly. ○ SL.4.4. Report on a topic or text, tell a story, or recount an experience in an organized manner, using appropriate facts and relevant, descriptive details to support main ideas or themes. • LS1.A: **Structure and Function** Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. (4-LS1-1) **Formative/Summative Assessments** Assessing the progress on the habitat portion of the note catcher for the website will determine next steps for interventions or extensions. Encourage students to self-assess with the rubric. **Resources** • Library books • Kiddle • World Book Online • Website Note Catcher

Explain	**Procedure:** **Day 2 –** Students will use the knowledge they gained about the habitat to determine what structural adaptations are necessary for their designed animal's survival in that habitat. Considerations: • Animals in the same animal group that you spun. • What do they look like? • What special features do they have on their body that help them survive? • Be creative and think of other adaptations from other animal

groups that would be useful for survival.

Students will then write about the structural adaptations for their website.

Day 3- It is time to write about behavioral adaptations. Things to consider before writing:

- How will they act? move? communicate? eat? hunt? stay safe? attract mates?
- What types of behaviors do you want your animal to use in order to survive?
- Again, think creatively and write about the behavioral adaptations for your website.

Modifications

Some students might benefit from working with a partner to complete the project.

Specific resources can be provided to ease the search. Using Newsela, leveled Lexile texts can be accessed.

Voice to text is also an option for the written portion.

Standards Addressed

- ELA: **Common Core State Standards for English Language Arts (CCSS ELA):**
    - W.4.2. Write informative/explanatory texts to examine a topic and convey ideas and information clearly.
    - SL.4.4. Report on a topic or text, tell a story, or recount an experience in an organized manner, using appropriate facts and relevant, descriptive details to support main ideas or themes.
- LS1.A: **Structure and Function**

  Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. (4-LS1-1)

Formative/Summative Assessments

Assessing the progress on the adaptations portion of the note catcher for the website will determine next steps for interventions or extensions.

Encourage students to self-assess with the rubric.

	Resources • Library books • Kiddle • Animal Encyclopedia • World Book Online • Website Note Catcher
Elaborate	**Procedure:** **Day 3:** Show students the following example of a discovery story for their website. *Discovering the Jadebird* *I was in the Amazon Rainforest, exploring for an assignment. Suddenly, I heard the rustle of wings and then I saw the Jadebird. Her wings were flapping wildly as a leopard tried to grab his attempted lunch. Suddenly, one of the Jadebird's wings struck his face. In a daze, the leopard ran away.* *None of the scientists in my team could identify the bird's species. We carefully put the Jadebird into a cage and brought her to the lab to be identified. After hours of waiting, the scientists in the lab peeked their heads out of the heavy lab doors. They shouted, "It's a new species!"* Students will create a backstory of how their animal was discovered. Considerations: • How were you involved? • What has happened as a result of discovering this animal? • Why did it take so long to discover this animal? • What is your animal called and why? • Be creative and use your storytelling language in this section to make it as believable as possible.

Day 4: Share the following example of the Jadebird.

Say: “You have the freedom to choose how you want to represent your animal and its adaptations. Some options you have are drawing, painting, modeling with clay, or even paper mâché! Remember your animal is unique and it must show the adaptations you shared in your writing about the website. Once you’re finished, you will follow the directions on your note catcher to use Google Drawing to upload your creation into your website. Then you will add labels and captions to describe the adaptations.”

Provide guidance and support as students create their animals and upload images. If the art teacher is available and willing to collaborate, take advantage!

Modifications:

Some students might benefit from working with a partner to complete the project.

Utilize support from the art teacher and peers.

Voice to text is also an option for the written portion.

Standards Addressed

- ELA: **Common Core State Standards for English Language Arts (CCSS ELA):**
    - W.4.2. Write informative/explanatory texts to examine a topic and convey ideas and information clearly.
    - SL.4.4. Report on a topic or text, tell a story, or recount an experience in an organized manner, using appropriate facts and relevant, descriptive details to support main ideas or themes.
- LS1-2: **Systems and Models**

  A system can be described in terms of its components and their interactions. (4- LS1-1)

- **National Core Arts Standards (NCAS):**
    - **Creating:**
        - VA:Cr1.1.4a Generate and conceptualize artistic ideas and work.
        - VA:Cr2.1.4a Organize and develop artistic ideas and work.

Formative/Summative Assessments

Assessing the progress on the animal creation and creation story portion of the note catcher for the website will determine next steps for interventions or extensions.

Encourage students to self-assess with the rubric.

Resources

- Jadebird example
- Art supplies: paper, pencils, markers, colored pencils, crayons, paints, clay, paper mâché materials
- Chromebooks

Evaluate	**Procedure:**
	Day 5: Tell students that once they are done, they should complete the following:
	• Go to preview mode to look at your website and consider the following:
	  ○ What looks good?
	  ○ What do you need to change?
	  ○ How can you make your website even better?
	  ○ Add more text, images, and even hyperlinks to improve your website?
	• Do you have extra time? Make a 5th page on your website that describes one of these areas: diet, life cycle, fun facts, etc.
	Say: "Once you are done with your website, you will publish it and we will add all of the links to one document so that other students will be able to view your work."
	Modifications
	Some students might benefit from working with a partner to complete the project.
	Utilize support from the art teacher and peers.
	Encourage students to extend their presentation by incorporating the Dash Robot from Wonder Workshop. They can add sound and movement to enhance their website with a video.
	Standards Addressed
	• ELA: **Common Core State Standards for English Language Arts (CCSS ELA):**
	  ○ W.4.2. Write informative/explanatory texts to examine a topic and convey ideas and information clearly.
	  ○ SL.4.4. Report on a topic or text, tell a story, or recount an experience in an organized manner, using appropriate facts and relevant, descriptive details to support main ideas or themes.
	• LS1-2: **Systems and Models**
	A system can be described in terms of its components and their interactions. (4- LS1-1)

	• **International Technology and Engineering Educators Association (ITEEA) Standards:** ▪ **Standard 5:** Design. Students will develop an understanding of the characteristics and scope of technology. ▪ **Standard 7:** Analyze the characteristics and scope of technology. Students will analyze the impact of technology on the environment and society. **Formative/Summative Assessments** Encourage students to self-assess with the rubric. After students have published their websites, use the rubric for a summative assessment. **Resources** • Chromebooks • Rubric • Library books • Kiddle • Animal Encyclopedia • World Book Online • Website Note Catcher • Wonder Workshop Dash robot

REFERENCES

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