THINKit

STEM WORKS THINKit

DIGITAL MEDIA

Community Need

Our community needs

Tech Tool Ideas:

Career Connections:

01 DEFINE THE PROBLEM

Define the Problem

Our engineering & design goal is to...

Our community is...

Three Criteria! We are successful if...

Three Constraints! Our solution is limited by...

02 GATHER PERTINENT INFO

Gather Pertinent Info

1.

2.

3.

4.

03 GENERATE IDEAS!

04 REFLECT & SELECT!

05 DESIGN SOLUTION!

06 TEST & OPTIMIZE!

07 SHARE & REFLECT!

STEM WORKS THINKit

Community Need

DIGITAL MEDIA | CODING

Students often miss school when they are sick and the doctor's office sometimes has a long wait. To help, a local doctor's office wants to have an educational game that people in the wait room can play. This game should be fun and also teach the community about ways to be healthy and get better.

Tech Tool Ideas:
Bloxels
Makey Makey

Career Connections:
Script Writer, Toy Maker
Video Game Designer

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1. How can games be used as educational learning tools?

2. Can you write dialogue to listen to or read in the game?

3. What health topic(s) will you teach?

4. How will you have the player interact with the information?

5. How can the doctor's office let parents or kids know about the game?

Unit Extension Ideas

Connect to the NGSS Standards!

After research (texts/media), students develop a game that teaches ways kids and parents can communicate to have what they need to stay healthy. How do people let others know what they need? Caregivers may respond by cooking, comforting, healing, and teaching other safe behaviors.

1st
- ❑ **PE:** Molecules to Organisms: Structures and Processes: 1-LS1-2: Read texts and use media to determine patterns in behavior of parents and offspring that help offspring survive.
- ❑ **SEP:** Obtaining, Evaluating, and Communicating Information
- ❑ **DCI:** LS1.B: Growth and Development of Organisms
- ❑ **CCC:** Patterns

Using specific examples, students explain how their game helps family groups to be healthier through making positive choices that may include topics: healthy food, protection from weather, safety in the environment, or coping with stress or difficult situations.

3rd
- ❑ **PE:** Ecosystems: Interactions, Energy, and Dynamics: 3-LS2-1. Construct an argument that some animals form groups that help members survive.
- ❑ **SEP:** SEP: Engaging in Argument from Evidence
- ❑ **DCI:** LS2.D: Social Interactions and Group Behavior
- ❑ **CCC:** Cause and Effect

Create a game about genetics, where the goal is to 'build organisms' by collecting genes. Through creative design of playing cards, game boards, or even clay models, a player creates organisms with characteristic traits from: (1) traits from normal genes on their chromosomes or (2) traits impacted by gene mutation, resulting in new features with harmful, beneficial, or neutral effects on the structure and function of the organism.

6-8
- ❑ **PE:** MS-LS3-1: Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism.
- ❑ **SEP:** Developing and Using Models
- ❑ **DCI:** LS3.A: Inheritance of Traits, LS3.B: Variation of Traits
- ❑ **CCC:** Structure and Function

Design reading material or an interactive model for families about genetics and heredity. Make it interactive, perhaps by including 'Q&A' or 'I spy a characteristic trait' or a genetic 'choose your own adventure' book. Include interesting characteristics or traits that children get from parents (example: eye color, blood type, ear lobes, etc.). Consider including scientific ideas about similarities and differences in DNA of different living things, known and unknown function of segments of genetic code, interaction of nature versus nurture, and even genetic modification!

9-12
- ❑ **PE:** HS-LS3-1: Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.
- ❑ **SEP:** Asking Questions and Defining Problems
- ❑ **DCI:** LS1.A: Structure and Function, LS3.A: Inheritance of Traits
- ❑ **CCC:** Cause and Effect

STEM works THINKit

Community Need

A local store sells beach items and wants to advertise their products while teaching the community about ocean safety. They want to display 5-10 second stop motion animations or a 1-3 minute VR experiences that's eye catching, upbeat, or even funny to deliver a message.

Tech Tool Ideas:
HUE Animation Studio
Animation apps
Aria Creator (VR)

Career Connections:
Marketer
Storyteller
Animator

Define the Problem

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02 GATHER PERTINENT INFO

1. What product will be advertised?

2. What will the safety message be?

3. Do the characters need to be human?

4. What is stop motion animation or what is virtual reality?

5. What will the script be? Is using humor appropriate?

6. Will a jingle help deliver a message?

7. How will the animation or experience be advertised in the store?

01	02	03	04	05	06	07
DEFINE THE PROBLEM	GATHER PERTINENT INFO	GENERATE MULTIPLE SOLUTIONS	REFLECT, ANALYZE, AND SELECT A SOLUTION	DESIGN CULTURALLY RESPONSIVE SOLUTIONS	TEST AND OPTIMIZE	SHARE AND REFLECT

Unit Extension Ideas

Connect to the NGSS Standards!

Focus on a specific ocean habitat: reef or tide pools. Include the diversity of different kind of organisms and how humans can practice ocean safety to both stay safe and keep organisms safe.

2nd
- ❏ **PE:** Biological Evolution: Unity and Diversity: 2-LS4-1. Make observations of plants and animals to compare the diversity of life in different habitats.
- ❏ **SEP:** Planning and Carrying Out Investigations
- ❏ **DCI:** LS4.D: Biodiversity and Humans
- ❏ **CCC:** (Project Specific)

Project contains explanation on how a specific product being advertised is an environmentally friendly solution/choice for the habitat and animals that live there. (For example: reef-safe sunscreen or floats to use when snorkeling).

3rd
- ❏ **PE:** Biological Evolution: Unity and Diversity: 3-LS4-4. Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.
- ❏ **SEP:** Engaging in Argument from Evidence
- ❏ **DCI:** LS2.C: Ecosystem Dynamics, Functioning, and Resilience, LS4.D: Biodiversity and Humans
- ❏ **CCC:** Systems and System Models

Research a current disruption of a physical or biological component of the reef ecosystem that has led to shifts in its populations of organisms. Use this information as evidence to support a claim for a needed solution to avert future ecosystem impact.
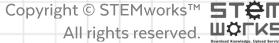
6-8
- ❏ **PE:** Ecosystems: Interactions, Energy, and Dynamics: MS-LS2-4 Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
- ❏ **SEP:** Engaging in Argument from Evidence
- ❏ **DCI:** LS2.C: Ecosystem Dynamics, Functioning, and Resilience
- ❏ **CCC:** Stability and Change

Research a natural or human-induced change in the reef environment that has contributed to the expansion of some species, the emergence of new distinct species, or the decline/extinction of some species due to the inability to adjust to change that is too drastic to be able to survive or reproduce. Use this information as evidence to support a claim for a needed solution to avert future ecosystem impact.

9-12
- ❏ **PE:** Biological Evolution: Unity and Diversity: HS-LS4-5. Evaluate the evidence supporting claims that changes in environmental conditions may result in (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.
- ❏ **SEP:** Engaging in Argument from Evidence
- ❏ **DCI:** LS4.C: Adaptation
- ❏ **CCC:** Cause and Effect

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PROTOTYPE · **DIGITAL MEDIA**

Community Need

Humans use a lot of plastic! For example, our clothing, soap, bottles, and tupperware can contain plastic! Plastic breaks down over time and is eaten by creatures that live in the ocean. Communicate a solution, build a model, or make a plan to reduce the impact of humans on water, land or animals.

Tech Tool Ideas:

Low tech (recyclables, posters, Formcard, Instamorph)

High tech (movie, blog, e-newsletter, Tinkercad)

Career Connections:

Ecologist

Designer

Biologist

Journalist

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02 GATHER PERTINENT INFO

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1. Why is plastic bad for the environment?

2. What are the current impacts of plastics on our water, land, or plants?

3. What is the history of plastic use and what will happen if we continue to use plastic at the same rate?

4. Can you make a plan to recycle more?

5. Are there environmentally sustainable alternatives to throw away objects?

6. Can you invent something that helps clean up current plastic? (For example, create a device that sifts sand and water to find small pieces of plastic.)

7. Are there biodegradable alternatives to plastic?

Unit Extension Ideas

Connect to the NGSS Standards!

Make a list of things that help a family live comfortably (food, electronics, objects, etc.). Rate each item on its environmental impact. Students choose one to redesign to reduce their impact on the land, water, air, or other living things.

K

- ❑ **PE:** Earth and Human Activity: K-ESS3-3: Communicate solutions that will reduce the impact of humans on the land, water, air, and/or other living things in the local environment.
- ❑ **SEP:** Obtaining, Evaluating, and Communicating Information
- ❑ **DCI:** ESS3.C: Human Impacts on Earth Systems, **EDP:** ETS1.B: Developing Possible Solutions
- ❑ **CCC:** Cause and Effect

What happens when animals eat plastics from our thrown away devices as food? The animal starves from nutrients as plastics move up the food chain and into the food web. When animals die, the plastic doesn't decompose and the cycle continues. Have students model a natural pathway of matter from plant to decomposer, with that of a diet including plastics. Use models to show nature's pathway of moving all matter through the environment.

5th

- ❑ **PE:** Ecosystems: Interactions, Energy, and Dynamics: 5-LS2-1. Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.
- ❑ **SEP:** Developing and Using Models
- ❑ **DCI:** LS2.A: Interdependent Relationships in Ecosystems, LS2.B: Cycles of Matter and Energy Transfer in Ecosystems
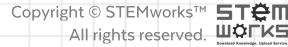- ❑ **CCC:** Systems and System Models

As human population grows, so does current per-capita consumption of natural resources. Have students plan a method for minimizing human impact on the environment and explain how their planned solution could help limit per capita consumption (include the plan's limitations as well as possible positive impact). Possible focus on energy, water use, land usage, pollution, etc.

6-8

- ❑ **PE:** Earth and Human Activity: MS-ESS3-3: Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
- ❑ ❑ **SEP:** Constructing Explanations and Designing Solutions
- ❑ **DCI:** ESS3.C: Human Impacts on Earth Systems
- ❑ **CCC:** Cause and Effect

Have students research and evaluate a current solution on how it reduces impacts of human activities on natural systems. Evaluate the solution by its cost, safety, reliability, aesthetics, and consider social, cultural, and environmental impacts. For evaluation, students may also consider the local and global impacts of pre-production and materials sourcing such as quantities and types of pollutants released, changes to biomass, species diversity, or areal changes in land surface.

9-12

- ❑ **PE:** Earth and Human Activity: HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.
- ❑ **SEP:** Science and Engineering Practices
- ❑ **DCI:** ESS3.C: Human Impacts on Earth Systems, **EDP:** ETS1.B: Developing Possible Solutions
- ❑ **CCC:** Stability and Change

Community Need

GIS & DRONE

DIGITAL MEDIA

Drone technology is excellent for creative photography. For the upcoming school open house, students want a photo booth featuring three photos from unique perspectives. The booth needs to be easy to operate, so students with little experience can run the booth.

Tech Tool Ideas:
Drone Technology
Drone Camera

Career Connections:
Photographer, Event Planner
Drone Pilot
Programmer

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1. How will you keep the experience safe?

2. To save time, how might you automate parts of the photo booth experience?

3. Drone batteries die quickly, how will you make sure the station is open for as long as it can be?

4. On a low cost budget, how might you share the photos with families?

5. What is your plan or system for training other people to help run the booth?

Step indicators:
01 DEFINE THE PROBLEM | 02 GATHER PERTINENT INFO | 03 GENERATE MULTIPLE SOLUTIONS | 04 REFLECT, ANALYZE, AND SELECT A SOLUTION | 05 DESIGN CULTURALLY RESPONSIVE SOLUTIONS | 06 TEST AND OPTIMIZE | 07 SHARE AND REFLECT

Unit Extension Ideas

Connect to the NGSS Standards!

Design a safety and training manual that communicates in diagrams and a series of sequential directions on how to run the photo booth. The manual might include one or more of the following: how to code and fly the drone, set up the booth, take photos, and share images.

K-2
- ❑ **PE:** Engineering Design K-2-ETS1-2. Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.
- ❑ **SEP:** Asking Questions and Defining Problems
- ❑ **DCI: EDP:** ETS1.A: Defining and Delimiting Engineering Problems
- ❑ **CCC:** Structure and Function

After the design process, students reflect on how their experience relates to the following statements. (1) Team communication is an important part of the process and can lead to more design solutions. (2) Researching the problem prior to creating a solution helps to broaden and inform solution ideas. (3) Testing to see how it performs under a range of likely conditions helps improvement. (4) Criteria help you design a solution and constraints limit your possibilities.

3-5
- ❑ **PE:** Engineering Design: 3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- ❑ **SEP:** Constructing Explanations and Designing Solutions
- ❑ **DCI: EDP:** ETS1.B: Developing Possible Solutions
- ❑ **CCC:** (Project Dependent)

Students compare and evaluate each other's processes using constructive critique on how it meets criteria and constraints. Affirm parts of the process that work and gives advise on how to improve what's confusing. Students explain how they would (or wouldn't) utilize feedback and then redesign to improve their solution.

6-8
- ❑ **PE:** Engineering Design: MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
- ❑ **SEP:** Engaging in Argument from Evidence
- ❑ **DCI: EDP:** ETS1.B: Developing Possible Solutions
- ❑ **CCC:** (Project Dependent)

As a team, using at least three criteria for design, focus and systematically approach a solution by making a plan for content. Make decisions about the priority of certain criteria over others (identify trade-offs).

9-12
- ❑ **PE:** Engineering Design: HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
- ❑ **SEP:** Constructing Explanations and Designing Solutions
- ❑ **DCI: EDP:** ETS1.C: Optimizing the Design Solution
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STEM WORKS THINKit

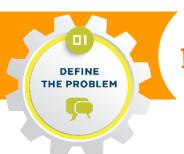### Community Need

VIRTUAL REALITY | DIGITAL MEDIA

A group of exchange students from Japan are coming to your school next year. These students and their parents are both nervous and excited about what life is like where you live. A virtual tour could really help prepare the students and families for the upcoming year at your school.

Tech Tool Ideas:
Google Street View App
Aria Creator
ArcGIS Story Maps

Career Connections:
Journalist, Storyteller
360° Photographer
Travel Concierge

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1. Are there ways or tools you can use to better support the communication of a second language?

2. What places would you share using virtual reality or virtual tours?

3. Are there any cultural or environmental differences that exchange students should learn about?

4. How does the technology work: Google Street View, Google Cardboard, Aria Creator, or ArcGIS Story Maps?

5. How will you digitally share the virtual tour with these students and their families before their travel?

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Unit Extension Ideas

Connect to the NGSS Standards!

What sequence of information would be helpful to virtually see or experience prior to visiting a new country? Students sketch a plan to 'virtually shape' their 360° scenes and information by making a plan of the best content and the sequence or location of these images to be viewed within a virtual 360° setting.

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