Making to Learn
Bringing an Academic Focus to Maker Education

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Participant Outcomes...

**Goal 1:** To understand the value of maker education

**Goal 2:** To connect maker education and content in a meaningful, sustainable way

**Goal 3:** To identify practical strategies and potential resources and networks for implementation
What is Maker Education?
Maker Education and 21st Century Learning

- Collaboration
- Communication
- Creativity
- Critical Thinking
Making to Learn: Connecting the Maker Movement to CCSS, NGSS, & 21st Century Skills

LEARNING
We’ve been doing make for a long time
Accessories

Bring your mission to life!

Each of the 21 California missions had its own character and scenery. Eager to make your project a standout success? Add Missions of California Educational Projects accessories and bring it to realistic life!

Fifty different pieces are available: figures of monks, Spanish soldiers and Native Americans; trees, shrubs and stalks of corn; wheelbarrows, water fountains and wishing wells; cannons, cactus plants and clay pots.

Use an almost unlimited amount of diorama-like detail to make your mission a masterpiece. It's fun, easy and inexpensive!

Click here to see a complete list of Mission accessories!
The SAMR Model Applies to Maker Education
The Maker Education Benefit: Getting a Lot for Your Investment

Engagement
The Maker Education Benefit: Getting a Lot for Your Investment

Perseverance
The Maker Education Benefit:
Getting a Lot for Your Investment

Writing practice
The Maker Education Benefit: Getting a Lot for Your Investment

Meaningful opportunities for collaboration and dialogue
The Maker Education Benefit: Getting a Lot for Your Investment

Engineering and design practice
The Maker Education Benefit: Getting a Lot for Your Investment

Marketable skills and expertise for the workplace
Education meets the workplace...
Medtronic is a medical technology and services company with more than 85,000 employees worldwide and $9.4 billion in revenue last year. There are about 950 employees in Santa Rosa where Medtronic's vascular division makes coronary stents and stent graft systems for treating artery disease.
How might maker education support the learning of students in my context?
The Only Time Innovation and Creativity are a No Go...

“Never, ever think outside the box!”
Making to Learn: Incorporating maker education into curriculum and the classroom

*Temptation*: Take a cool maker idea and smash it into the curriculum - make it work!

*Frameshift*: Start with the content and determine when and how making might support student learning.
Maker Education and Science
How do humans throughout the world disrupt the Carbon Cycle?
NGSS Standards

**MS-ESS3-3:** Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.*

**HS-ESS3-4:** Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.*
HS-LS4-2: Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.
What is “Fitness”???
The ability to survive and reproduce.
Maker Challenge: Potato Environments!!!
Mr. Potato Head’s Spudtacular Evolutionary Adventure

1. Form a group of 2-3 people.
2. Select an environment card.
3. Brainstorm traits that would give Mr. Potato Head the highest fitness level in the environment.
4. Design and make prototypes of the traits.
5. Build your model Mr. Potato Head. Be prepared to argue for why your traits give a higher fitness.
6. Environment change! Follow the directions for Part II (as time allows)
<table>
<thead>
<tr>
<th>Things that I liked the most</th>
<th>Things that could be improved</th>
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<tbody>
<tr>
<td><img src="image1.png" alt="Smiley" /></td>
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<table>
<thead>
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<th>Things that I don't understand</th>
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<td><img src="image3.png" alt="Question Mark" /></td>
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## Maker Rubric

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<thead>
<tr>
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<th>Emerging</th>
<th>Approaching</th>
<th>Proficient</th>
<th>Distinguished</th>
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<tr>
<td><strong>Content Mastery</strong></td>
<td>Student demonstrates <strong>limited</strong></td>
<td>Student demonstrates understanding of</td>
<td>Student demonstrates understanding of curricular</td>
<td>Student demonstrates understanding of curricular</td>
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<td></td>
<td>understanding of curricular content.</td>
<td>curricular content and its applications.</td>
<td>content and its applications. Student can articulate how his/her design relates to curricular content.</td>
<td>content and its applications. Student can articulate how his/her design enhances others' understanding of curricular content.</td>
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<tr>
<td><strong>Viability</strong></td>
<td>Product does not work/function as</td>
<td>Product does not work/function as</td>
<td>Product works/functions as intended.</td>
<td>Product works/functions as intended and student can provide rationale for design choices.</td>
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<td>intended.</td>
<td>intended, but student can explain why</td>
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<td>and has a plan for revision.</td>
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<td><strong>Process</strong></td>
<td>Some of the following elements of the</td>
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<td>All of the following elements of the process are</td>
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<td><strong>Maker Mindset</strong></td>
<td>Student does not investigate a</td>
<td>Student investigates <strong>only one</strong></td>
<td>Student investigates multiple designs <strong>iterates a</strong></td>
<td>Student investigates and iterates multiple designs.</td>
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<td>design.</td>
<td>design and does not iterate.</td>
<td>single design.</td>
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<td><strong>Agency</strong></td>
<td>Student is not yet able to monitor</td>
<td>Student is able to monitor his/her</td>
<td>Student is able to monitor his/her ability to benefit from and contribute to the activity (e.g.: discussion, team meeting, independent time) <strong>with</strong> reminders or other assistance.</td>
<td>Student consistently monitors his/her ability to benefit from and contribute to the activity (e.g.: discussion, team meeting, independent time) <strong>without</strong> reminders or other assistance.</td>
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Success

what people think it looks like

Success

what it really looks like
Come visit the Makerspace to learn more!
Potato Head Environment #1: Taterhiti Island

Taterhiti Island is found far off the coast in the Pacific near the equator. It’s sunny on the island about 300 days a year, and the sunshine is intense! This particularly affects those with lighter colored eyes- they tend to go blind in early adulthood. Any kind of sun protection is advantageous. Food abounds on the island, but it’s not always easily accessible. Taterhiti boasts trees 40-50 feet tall, and much of the island’s famous fruit grows near the top of the trees. Those able to climb and reach are most successful at collecting these nutritious treats. Finding fresh water can also be a challenge. There are plenty of underground pools, but they’re hard to find. It takes a good nose to find where to start digging, and it’s helpful to have a light source when digging deep as it can get dark underground. Also on the ground are fryer beasts that find spuds particularly tasty. They are, however deterred by the threat of being bitten by their would-be lunch. The ladies of Taterhiti love a man with facial hair, but this can also be a hindrance to biting enemies and smelling out water sources.
Potato Head Environment #2: Spudbank Ridge

Spudbank Ridge is in the far north and is covered in snow and ice seven months of the year. Like most northern environments, the days are short and the nights long and dark! Luckily, a large group of miniature dogs call the ridge home and are the constant companions of other residents. The Potato Heads are particularly good at riding them and so can travel great distances to search for food. But the dogs move fast, and you have to have strong arms and a good grip to hold on! Hypothermia is a constant threat, and spuds are particularly susceptible to losing heat through their heads. Due to a lack of sunlight, Vitamin D deficiency is also a danger. Lighter pigment helps with Vitamin D absorption, but when the sun does shine this makes creatures less able to see and avoid danger due to the glare off the ice. Gravy flows (warm and nutritious) are present deep under the ice. To reach a drilling place, a creature must be sure-footed. Once the gravy is reached, a mouth capable of collecting and holding large amounts of liquid is desirable. There are few ladies in this harsh environment, and they are picky. The ideal man at Spudbank is strong but sensitive and capable of good conversation to make the long winter nights pass more quickly.
Potato Head Environment #3: FrenchFried Ravine

FrenchFried Ravine is a tiny remnant of the Wild West. Like any desert environment, temperatures vary dramatically- it is routinely over 100 degrees Fahrenheit, but the temperature can plummet to near freezing in the winter months. The days are bright and the nights are pitch black unless the moon is full. Those living in the ravine have few neighbors and are always on the lookout for allies but wary of enemies. It’s best to appear friendly but not simple or gullible. Female spuds have shown great skill at building shelters in the harsh desert, but they won’t often invite a male Potato Head to share the home. For a woman to consider this, she has to be convinced that a man is madly in love and pays close attention to personal grooming. Sunburn is a constant threat in this open desert, and darker pigmentation and smaller features are an advantage. However, in order to ride and tame the wild ponies from the area, one has to have upper body flexibility. Food is varied. There are lots of little fry spats running around that can make for a tasty treat, and there are also cacti full of nutrients…if one can reach in between the spines!
Potato Head Environment #4: Burning Tuber

The Burning Tuber settlement is found on a dry lake bed (playa) in the middle of the Hot Potato Desert. The desert is 4,000 feet above sea level and very warm and dry, but the temperatures can drop more than 50°F when the sun goes down. Because of all the dust and wind on the playa, white-outs are a large threat. Potato Heads with eye and face protection are more likely to survive these dust storms without permanent damage. In the winter months, rain storms are also problematic for Potatoes—unless they have feet capable of gripping and climbing they’re likely to get stuck in the quicksand-like mud that forms on the playa floor. It’s very dark at night, so one has to have a light source to find shelter, keep warm, and be protected from the vicious jackrabbits and kit foxes that roam the playa. The ladies of Burning Tuber prefer men who display radical self-reliance and self-expression. They seek out male Potato Heads who can build their own fires and are artistic. They also prefer tidy taters who can clean up after themselves and store trash and waste to hike out over the mountains, leaving no trace of garbage on the playa. Since water is scarce in Burning Tuber, Potato Heads have to be able to store and carry large amounts of water when they do find a source. Electrolyte imbalance is a consistent problem in the heat, so Potato Heads need large, sensitive tongues to detect the salty sage plants that grow around the area. But the salty sages typically grow near oil hot springs covered in a thin layer of clay. Unless Potato Heads have good heat sensors in their hands and feet, they might fall in and find themselves fried!
Mr. Potato Head’s Spudtacular Evolutionary Adventure

Your group is assisting a team of scientists attempting to find and study a rare and elusive population: the Potato Heads (otherwise known as *Potatus headius*). Sadly, the species is now all but extinct, and the team is having difficulty locating the surviving creatures. They have made models of the basic Potato Head body structure previously observed and found in the fossil record. They have also carefully documented the different environments Potato Heads have been known to inhabit. Your job is to develop prototypes of specific traits Potato Heads ideally suited to different environments might have and then make complete models for the scientists to work with. Since the team has (shockingly) not taken biology, you also need to help them understand the impact environmental change can have on traits. All of this will help the team determine where Potato Heads might still be found and what they would look like.

*Note:* All brainstorms, discussions, and models are to be completed as a group. If this activity were being used with students, reflection prompts would be discussed, but the final written version would be completed individually.

I. Fitness and Environment: Developing a Potato Head Model

*Help the scientists understand fitness and how it is connected to a specific environment.*

1. Select an environment card.
2. Brainstorm what resources might be limited in the environment and what competition might exist between members of the Potato Head population.
3. Design traits that would give Mr. Potato Head the highest possible fitness level in the environment. You may want to sketch these or write descriptions.
4. Make prototypes of 2-3 traits using the materials and tools available.
5. Construct your Potato Head model complete with the traits.

*Reflection Prompt 1:* The scientists studying the Potato Head population would like to know why you think this particular Mr. Potato Head would have the highest fitness in the environment. Give an explanation detailing how the traits you designed contribute to overall fitness. Give evidence to justify your response!
II. Evolution and Environmental Change
The team doesn’t really understand that environmental changes may impact the Potato Head population. Help them understand how and why the population might change.

1. DISASTER!!! A major environmental change has occurred. Select a different environment card.
2. If possible, compare your Mr. Potato Head model with that of a group who originally had your second environment card. What similarities and differences do you notice?
3. Discuss as a group what will become of your Potato Head in the new environment. Specifically, what will happen to his fitness level?
4. Make a prediction about what will happen to the Mr. Potato Head population you modeled if it stays in the new environment long-term. Be able to support your prediction with evidence.

Reflection Prompt 2: The scientists are a little confused about the term fitness. In terms of adaptation and evolution, is fitness a term or concept that is rigid, or is it something that changes? Give evidence from the activity to support your answer.