Activity: Create a Crampon Model

Crampons are metal plates with spikes fixed to a boot for walking on ice or rock climbing. Before crampons were commercially available, climbers had to make their own. Members of the 1910 Sourdough Expedition used homemade crampons during their ascent of the north peak of Denali, making their own tools to solve the challenges they faced.

Making a model or replica of a historic object can help us understand the work involved in creating an object, and connects us to the people who made and used these items.

Main Ideas

1) Looking closely at collection objects shows us how they were made and connects us to the people who made and used them.
2) Engineers create solutions to everyday challenges.

Learning Objectives

Students will:

- Practice observation skills by looking closely at a historic object.
- Describe and use the steps of the Engineering Design Process to solve an engineering challenge.

Learning Standards

Alaska Science Content Standards: A. A student should understand and be able to apply the processes and applications of scientific inquiry.

Additional Resources

"Sourdough" Crampons: www.google.com/culturalinstitute/beta/exhibit/mwLSpGOXWnRSKw
Engineering is Elementary: www.eie.org/overview/engineering-design-process

Time Needed: 30-45 minutes

Materials

- Photographs of "Sourdough" Crampons and contemporary crampons
- Craft materials (cardboard, pipecleaners, popsicle sticks, wooden dowels, felt pieces, string, wire, etc.)
- *History of Crampons* handout (optional)
- *Engineering Design Process* worksheet (optional)

"Sourdough" Crampons, 1910

Courtesy of Denali National Park and Preserve Museum Collection, DENA 405AB.

Activity: Create a Crampon Model

Directions

- Show photos of the crampons from the Sourdough Expedition, along with photos of contemporary crampons. Ask students if they have seen or used crampons before. What is the problem crampons are designed to solve? (Refer to the *History of Crampons* handout.)

- Brainstorm with students how they could construct their own crampon model.

- Introduce the Engineering Design Process of ask, imagine, plan, create, and improve (see handout). Use the process to guide student progress.
    - *Optional:* Have students fill out the *Engineering Design Process* worksheet as they complete each step.

- Working individually or as a group, have students make a crampon model from craft materials.
    - Students can draw pictures of their crampon designs before constructing them. Older students may want a wider variety of craft supplies.

- Encourage students to experiment with different designs and materials.

- *Wrap Up:* Ask students to identify the easiest and hardest parts of creating their crampon model. Did their initial designs work? How did they modify their designs?
    - Discuss reasons why the members of the Sourdough Expedition made their own crampons, instead of buying commercially made ones. What are the advantages and disadvantages of making your own equipment?
    - Ask students how the process of making a model helped them to appreciate or understand the “Sourdough” Crampons in a deeper way. How did it help them understand the experiences of the 1910 Sourdough Expedition members as they climbed Denali?

Students creating a crampon model. UAMN photo.

Crampon model. UAMN photo.

"Sourdough" Crampons

Courtesy of Denali National Park and Preserve Museum Collection, DENA 405AB.

"Sourdough" Crampons Information

This is a pair of crampons for climbing boots, with points on the bottom and slotted uprights for boot straps on top. They are made of galvanized sheet metal. The front and back sections are hinged to bend with the boot. Two rivets for the strip attaching front and back sections of the right crampon are missing.

The homemade crampons were left on the Muldrow Glacier on Denali (Mount McKinley) by members of the 1910 Sourdough Expedition. In 1932, the Lindley-Liek Expedition found and recovered them.

In November 1909, four gold miners - Tom Lloyd, Peter Anderson, Charley McGonagall, and Bill Taylor - set out to be the first to climb Denali. They wanted to win a bet, and to disprove explorer Frederick Cook's claim that he had summited Denali in 1906. The trip began in December 1909 as the group left Fairbanks with their horses, mule, and dog teams.

On April 3, 1910, the group, minus Lloyd, attempted to reach the summit. With a bag of doughnuts, three thermoses of hot chocolate, some caribou meat, and a 14-foot spruce pole, they became the first party to summit the 19,470-foot north peak of Denali. They became known as the Sourdough Expedition, and had met the challenge of climbing with what is considered rudimentary gear and no technical climbing experience. In 1913, the Stuck-Karstens climbing party saw the spruce pole when they summited the south peak and verified that the Sourdough Expedition had successfully summited the north peak.

Information from National Park Service Centennial One Object Exhibit:
www.google.com/culturalinstitute/beta/exhibit/mwLSpGOXWnRSKw

Examples of Contemporary Crampons

www.gooutdoors.co.uk/petzl-lynx-crampon-p279266

www.simond.com/makalu-strap-crampons-id_8320463

www.rei.com/product/100169/petzl-irvis-flexlock-crampons-pair

History of Crampons

Late 19th century: Full-foot crampons become available, but did not become popular. Most climbers at the time used nailed boots, which had spikes built into their soles.

1908: Oscar Eckenstein, an English climber, designed what is generally considered the prototype for the modern-day crampon. He worked with a blacksmith to design a steel device with 10 long, sharp spikes. These crampons could be attached to regular hiking boots.

1910: Henry Grivel makes Eckenstein's design commercially available.

1913: Lieutenant Trémeau develops the first adjustable-length crampon.

1929: Laurent Grivel (Henry's son) adds two front points to the 10-point design, enabling climbers to tackle steep ice. The twelve-point crampon becomes the standard for mountaineering and glacier travel.

1967: Yvon Chouinard and Tom Frost develop rigid-frame crampons. Rigid crampons are designed to provide a stable platform to stand on, reducing fatigue and increasing precision.

10-point crampons designed by Oscar Eckenstein.
Scottish Mountain Heritage Collection: www.smhc.co.uk

12-point crampons designed by Laurent Grivel.
www.grivel.com/inc/read_more_crampons.php

Sources:
What's a Crampon?: www.gadventures.com/blog/whats-crampon-history-behind-cold-climate-trekking-essential/
History of Crampons Timeline: www.climbing.com/gear/history-of-crampons-timeline-no-226/
Choosing the Right Crampons: www.gearx.com/blog/2015/01/23/choosing-right-crampons/

Engineering Design Process

Engineers create solutions to our everyday needs. To create these solutions, engineers follow the Engineering Design Process. The image below was created by the *Engineering is Elementary* project at the Museum of Science, Boston. It lists five steps to achieving an engineering design challenge.

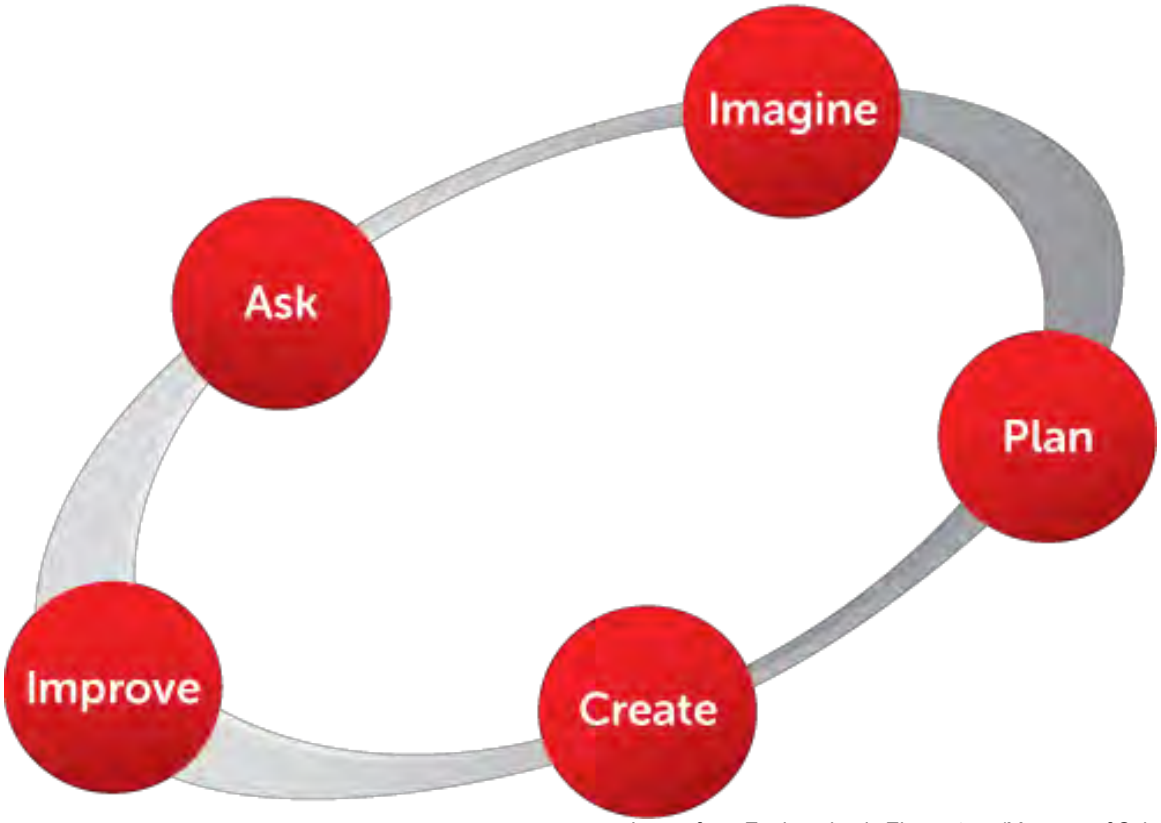


Image from Engineering is Elementary (Museum of Science, Boston)

Engineering is Elementary defines each step as follows:

ASK: What is the problem? How have others approached it? What are your constraints?

IMAGINE: What are some solutions? Brainstorm ideas. Choose the best one.

PLAN: Draw a diagram. Make lists of materials you will need.

CREATE: Follow your plan and create something. Test it out!

IMPROVE: What works? What doesn't? What could work better?

Modify your design to make it better. Test it out!

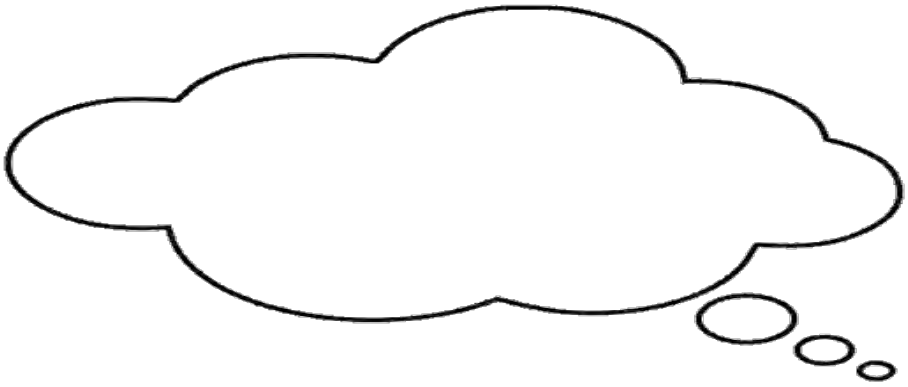
Source: Engineering is Elementary: www.eie.org/overview/engineering-design-process

Student Worksheet:

Engineering Design Process

Ask: What is the problem?

Imagine: What are some solutions? Brainstorm ideas.



Plan: Draw a diagram. Make a list of materials.

Create: Follow your plan and create something. Test it out!
Record your observations:

Improve: What works? What doesn't? What could work better?

Modify your design and test it again!