Incorporating Engineering in the Biology Classroom (Curriculum Exchange)

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Hooves, and Paws, and Claws. Oh my!: A STEM Integration Unit  
(Curriculum Exchange)

Target Grade Level: 5-8

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Project Description
The Engineering to Transform the Education of Analysis, Measurement, & Science (EngrTEAMS) project is an engineering, design-based approach to teacher professional development that has 50 teachers per year designing curricular units for science topic areas related to the Next Generation Science Standards. The project includes summer professional development and curriculum writing workshops, paired with coaching, to allow teams of teachers to design engineering curricular units focused on science concepts, meaningful data analysis, and measurement. Each unit goes through an extensive design research cycle to ensure its quality and is published in an online format. The unit, *Hooves, and Paws, and Claws* shared with the teachers in the summer professional development program and teachers were asked to develop a unit similar to this unit.

Unit Description
This five-lesson unit is designed for students in grades 5-8 to learn about adaptation and engineering design. The unit addresses the following NGSS: Disciplinary core ideas: LS4.C, Crosscutting concepts: Cause and effect, and Engineering Practices: ETS.1.A-C. This unit begins by introducing the problem people have with slipping on ice due to poor foot traction during Minnesota winters. Students are challenged to look into ways nature has already solved the problem. The engineering challenge charges students to design a shoe that is inspired by “Mother Nature’s Shoes” that will work to prevent slipping on ice. The unit includes a pre and post content test to measure student content learning and a rubric to measure student engineering design solutions.

Unit Summary

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<tr>
<th>Lesson</th>
<th>Objectives</th>
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<tr>
<td><strong>Lesson 1: The Greatest of Feet</strong></td>
<td>To introduce foot adaptations of a variety of animals, conduct research to build and present knowledge, and introduce the engineering challenge.</td>
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<td><strong>Lesson 2: Does Size Matter?</strong></td>
<td>To calculate area of irregular shapes and analyze data to inform the design of the shoe.</td>
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<td><strong>Lesson 3: Initial Design</strong></td>
<td>To create an initial drawing of the shoe that includes characteristics of shape, area of contact with the ice, and materials that will contact the ice. Students use mathematics and science content in design justifications.</td>
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<td><strong>Lesson 4: Hairless Hares</strong></td>
<td>To model evolution by natural selection. Students model change in gene frequency in a population of snowshoe hares over time.</td>
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<td><strong>Lesson 5: Nature Inspired Shoes</strong></td>
<td>To create their prototypical shoe design based on the characteristics they identified as being the best fit to prevent slipping on an icy surface. Students test their prototype and redesign the model.</td>
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