SCIENCE MUSEUM OF MINNESOTA ENGINEERING RESIDENCY, GRADES 3-5

Class sessions & Logistics

Overview

Students perform hands-on investigations to develop deeper understanding of principles introduced in the Engineering 3-5 Assembly. Air Dancers and Super Structures can be taught independently of each other. Wind Tube Science provides context setting for Wind Tube Design, and are meant to be taught consecutively.

Air Dancers Session

Design teams create models of devices that would hold a person for a new amusement park ride. The rider is attached to the team's designed construction which they test in a column of rising air. Teams will use the Engineering Design Process (Ask, Imagine, Plan, Create, Improve) again and again as they strive for a design that balances the forces of gravity and air, and that meets the design criteria.

Science Learning Goals

- Engineers are people who solve problems creatively using their knowledge and understanding of math and science.
- Engineers use a design process to develop and refine multiple solution options to a problem. SMM uses the process of Ask, Imagine, Plan, Create, and Improve.
- Moving air can provide a force than can lift and support an object. Changing the object' shape, size weight and/or materials affects its motion.

Vocabulary Introduced:

- Engineering, Technology

Super Structures Session

Different shapes have different strengths. Students can build shapes with strength by connecting dowels with rubber bands and use these shapes to construct either a tower or a bridge that supports weight. However, this is not possible with simple building techniques; the structures must be reinforced to be a "super structure."

Science Learning Goals

- Students experience the relative strengths of different geometric shapes and how well they respond to a load.
- Students work cooperatively to problem solve and apply their knowledge to engineer a solution to a problem.
- Geometric principles can be applied to help solve real-world challenges.

Vocabulary Introduced:

- Engineering, Technology, Load, Truss, Span

If you have further questions on bringing programming to your school, please contact our Outreach Registration Coordinator at (651) 221-4748 or schooloutreach@smm.org.

Wind Tube Science and Wind Tube Design Sessions

These two sessions give students deeper engagement with the Engineering Design Process. During the first session, students investigate how various materials move in a wind tube and determine what factors affect their motion. They apply that knowledge in the second session to design a device that shows a certain type of motion in the wind tube. Teams record measurements and observations in both sessions as they use the Engineering Design Process to guide their problem solving.

Science Learning Goals

- Wind is a force that can push against tings and make things move.
- An object's motion can be affected by forces working against each other.
- Changing the size, shape or weight of an object can affect its motion.
- Engineers use their knowledge of math and science and their creativity to develop objects, systems or process to solve problems.
- Engineers use thinking process which include defining a problem, developing possible solutions, and comparing different solutions.

Vocabulary Introduced:

- Gravity, Force, Motion, Measurements

Program Length: 50 minutes
Audience Size: Up to 30 students
Preparation: Science Museum instructor brings all needed equipment and materials. School provides two tables for assembly demonstration and access to electricity. Allow 60 minutes before and after program for set-up and take-down. School provides classroom space for the residency sessions. Materials can be moved from room to room, or taught in a designated space with tables and chairs for students and two tables for teaching materials and equipment.

Standards
MN Academic Standard Strand
The Nature of Science and Engineering (3.1.3.4.1; 4.1.2.2.2; 4.1.2.2.3)
Physical Science (5.2.2.1.2)

Next Generation Science Standards
Disciplinary Core Ideas:
Engineering Design – Defining and Limiting and Engineering Problem (ETS1.A)
Engineering Design – Developing Possible Solutions (ETS1.B)
Engineering Design – Optimizing the Design Solution (ETS1.C)
Forces and Motion (3-PS2-1; 3-PS2-2)
Types of Interactions (5-PS2-1)

NGSS Crosscutting Concepts:
Structure and Function
Cause and Effect
Patterns
Systems and Systems Models
Connections to Engineering, Science, Technology and Applications of Science

If you have further questions on bringing programming to your school, please contact our Outreach Registration Coordinator at (651) 221-4748 or schooloutreach@smm.org.