Science Museum of Minnesota

SciEd.

Experience Engineering
Grades 2-6

Experience Engineering at the Science Museum

- Museum Activities for Grades 2-6
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- Connections the Minnesota Science Standards

In This Guide

Explore engineering at the Science Museum by doing engineering design challenges in the Engineering Studio on Level 3, by looking at exhibits to determine how the exhibit designers used engineering to build them, and by observing the many types of technology that exist in the museum and along the Mississippi River.

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How to Use this Explorations Guide

Give chaperones copies of the ***For the Teacher and Chaperone: Experiencing Engineering at the Science Museum*** pages and the chaperone guide. Please do this before the field trip.

- Add your own pages such as blank sheets for students to make notes on or to add drawings.
- Provide extensions of museum experiences back at school (see post activities suggested on the Activity Descriptions.)
- Prepare your students for the day by introducing the activities. Discuss what they will do in the activities and what they will do for the student page. Also review the schedule of the day and behavior expectations.
- Provide students with pencils and student sheets fastened to a stiff backing such as cardboard. Teachers have packed these materials in easy-close bags for each chaperone.

Connections to Minnesota Science Standards

1. The Nature of Science and Engineering

Sub-Strand 2. The Practice of Engineering

- **Standard 1.** Engineers design, create and develop structures, processes and systems that are intended to improve society and may make humans more productive. **(Grade 4, 6)**
- **Standard 2.** Engineering design is the process of identifying a problem and devising a product or process to solve the problem. **(Grade 2)**
- **Standard 2.** Engineering design is the process of identifying problems, developing multiple solutions, selecting the best possible solution, and building the product. **(Grade 4, 6)**
- **Standard 3.** The needs of any society influence the technologies that are developed and how they are used. **(Grade 4)**

Sub-Strand 3. Interactions Among Science, Technology Engineering, Mathematics, and Society

- **Standard 1.** Designed and natural systems exist in the world. These systems consist of components that act within the system and interact with other systems. **(Grade 6)**
- **Standard 2.** Men and women throughout the history of all cultures, including Minnesota American Indian tribes and communities, have been involved in engineering design and scientific inquiry. **(Grade 3, 5)**
- **Standard 3.** The needs of any society influence the technologies that are developed and how they are used. **(Grade 4)**

For the Teachers and Chaperones

Experiencing engineering at the museum

The many things visitors see and use at the Science Museum are examples of technology. A basic definition of technology is ***"something that is created by people to solve a problem or meet a need."*** *(Engineering is Elementary™)*

The technology in the exhibits means more than the parts that use electricity, involve a computer, or are even operated by pushing buttons. The design and physical construction of an exhibit are also technology as well as the parts a visitor uses.

Each exhibit was created with a purpose. They were designed by people who have an understanding of engineering. These people followed a certain way of thinking—a design process. First, the development team considers many possibilities as they design the appearance, components and signage. They use their knowledge of science and math to make creative decisions on what to include in the exhibit, how to construct it, what to have written on the signs, and what pictures and graphics to use. They may also build prototypes of the exhibit to see what visitors thought of it. The development team could also get feedback from these visitors as well as other people at the museum to evaluate how well the exhibit meets its purpose. The team makes final improvements to the exhibit, and then steps back to enjoy seeing how the exhibit engages learners of all ages.

Do engineering (Level 3)

Students will experience thinking like engineers by using engineering design processes and skills. They will also use their knowledge of math and science, and their creativity to solve a problem or design an object.

Goals for this experience include:

- engage in the social process of engineering design
- use engineering design to learn about yourself and the world
- understand that engineering impacts society and that society influences engineering.

DEFINITIONS

Technology:
Objects or processes created by people to solve a problem or meet a need.

Engineering:
The use of math and science, and a person's creativity to design objects and processes to solve problems.

Engineering design process:
Steps used by engineers to design technology. These steps can include ***Plan, Make, Test, Revise***.

Engineering is creative problem-solving

Students can also experience engineering and technology by examining one exhibit to observe how it is made, to think about what materials are used to build it, and to figure out how it works. As your students discuss the types of problems designers considered as they developed the museum exhibits, they will appreciate the designers' creativity and their understanding of math and science.

We live in an engineered world

The Science Museum's location along Shepard Road and the Mississippi River provides a unique view of the engineered world. Students can observe and list various types of technology they see out the museum windows, identify technology systems that are made up of multiple related parts, and discuss what happens if one part of a system is changed. As students observe their world, they will become more aware of what is engineered and why people developed them.

In the museum

Engineering is Creative Problem Solving: Displaying Dinosaur Skeletons

LOCATION:

Level 3—Dinosaur and Fossils Gallery; *Stegosaurus* and *Diplodocus* skeletons

TIME:

Allow 10 minutes

SUGGESTED GROUPING:

Teams of 3–4 people

Student activity:

PART ONE. MAKE OBSERVATION:

Have students examine the skeletons *Stegosaurus* and *Diplodocus* skeletons to observe how they are displayed and supported.

- What holds the bones together?
- What about this connection system is the same/different between the *Stegosaurus* and *Diplodocus* skeletons?
- What keeps the skeletons from falling down?
- What about this support system is the same/different between the *Stegosaurus* and *Diplodocus* skeletons?

PART TWO. THE ENGINEERING CHALLENGE:

Tell students this engineering challenge:

"How can a museum display large dinosaur skeletons in realistic poses so that the skeletons don't fall down."

- What are some/challenges you think there could be in displaying skeletons?
- What problems did the designers need to solve to be able to display these particular skeletons?
- What would you do differently to either hold the bones together or keep them from falling down?

POST-VISIT ACTIVITY:

Design a connection system or support system for a snowflake shaped sculpture made out of clear plastic balls that are 4 or 8 inches in diameter. The structure is 12 feet tall and 12 feet wide.

In the museum

We live in an engineering world: Looking out the windows

LOCATION:
Level 5—Large windows in the Mississippi River Gallery overlooking the river

TIME:
Allow 10 minutes

SUGGESTED GROUPING:
Teams of 3–4 people

Student activity:

Take students to Level 5. Go to the large windows that overlook the Mississippi River. Tell students to look out the windows and observe what people have made to solve problems or meet needs.

- Can they find at least 25 things?
- How many different things can they name in two minutes?
- What things solve different parts of a problem?

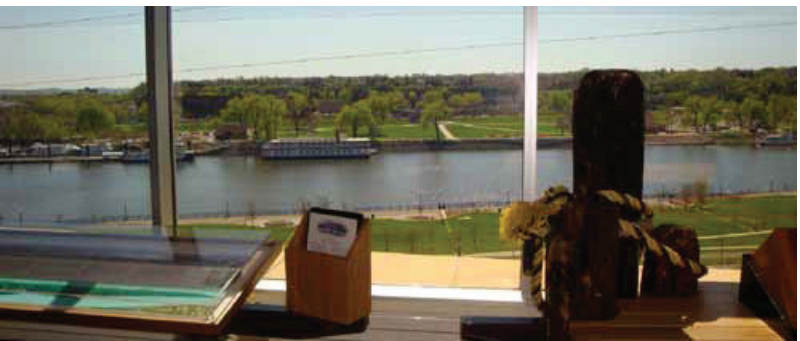
For example, Problem: docking a boat

Solving the problem includes:

- locate a place along the river to build the dock
- design a dock
- design a way to hook the boat to the dock
- design a way to connect the dock to the shore

POST-VISIT ACTIVITY:
Think about the things you use everyday that are engineered. List as many as you can. Develop a creative way to share your list (poster, puppets, a story, poem, song, skit) and produce it.

Challenge: Choose things that are related to each other as the theme of your project.



Do Engineering!

LOCATION:
Level 3—Near the stairs

TIME:
Allow 15-20 minutes

SUGGESTED GROUPING:
Teams of 3–4 people

The opportunity "do engineering." Visitors can use a basic engineering design process, ***plan, make, test, revise***, to develop solutions to problems such as:

- determining how ***wind turbine blades*** affect the amount of generated electricity
- designing a device to fly in ***giant sized wind tubes***
- using hydraulic pumps to move a ball along your designed ***ball run***

Look for more and engineering challenges.

Student activity:

Participate in a design challenge activity.

POST-VISIT ACTIVITY:
Report to the class about your/your team's design challenge and solution.

- What problem were you trying to solve?
- Draw your solution (the plan). Please include labels to help others understand your solution. Talk about how you built, tested and improved your solution.
- What did you enjoy about this activity?
- If you had a chance to do this activity again, what would you do differently?

Chaperone guide

Tips

- Allow a few minutes of time for students to explore and investigate the exhibits when you and your group enter the different parts of the museum.
- Gather your group at the suggested location for the Explorations activity (see pp. 4+5). Each activity has a suggested amount of time. If possible, divide your group into smaller teams for the activities.
- Guide students through the activity by asking the questions or questions you or the group develops.
- Share the excitement! Talk about the exhibits, the students' observations and experiences.
- The ***BIG IDEA*** for each activity is to enable students to be more aware of engineering and how it is used at the Science Museum and in our daily lives.

Asking questions

The questions in this guide are designed to get the students "thinking like engineers". An engineer is a person who uses their knowledge of math and science, and their creativity, to solve problems. Students can do this at the Science Museum by looking for examples of engineering, thinking about problems and designed solutions, and doing engineering themselves.

- Activity questions are open-ended and do not require specific answers.
- Use them as starting points for discussions.
- Also consider using these questions:
  - Tell me more about that.
  - What else do you see/hear/feel/notice?
  - How do you know?
- Encourage students to ask their own questions. The group can work together to answer them. A question might require students to do more research back at school. Please record student questions here:

Questions Students ask:

YOUR NAME: _____

Student pages

Do engineering in the Experiment Gallery

What design challenge were you trying to solve?

Draw or write about your solution.

Engineering is creative problem-solving: displaying dinosaur skeletons

What challenges do you think there could be in displaying dinosaur skeletons?

How did the designers solve these challenges in the dinosaur skeletons displayed at the Science Museum?

We live in an engineered world: looking out the windows

Write down 5 things you see outside that people made to solve problems or meet needs.