Science and Innovation
A Boeing/Teaching Channel Partnership

BOLT CATCHER
Teacher Handbook
Lesson Overview

In these optional opening days, students research various engineering careers and present their findings to their classmates. They learn about the field of engineering and how engineers begin the process of designing and creating new products. Students also learn that engineering plays an integral role in our daily lives. In an optional extension, students gain firsthand knowledge from actual engineers about their field of work.

Days 1 and 2 are designed to allow for the integration of Common Core State Standards into the module. After learning about engineers on Days 1 and 2, students engage in science and engineering practices to solve the design problem presented on Days 3 through 10.

Connecting to the Common Core State Standards

The central focus of Days 1 and 2 is to help students make progress on the key Common Core State Standards in English Language Arts listed below. The lesson should be modified according to each teacher’s needs to meet one or two key Common Core State Standards for English Language Arts.

Connections to the Common Core State Standards

Days 1 and 2 can be easily adapted to support student growth in one or more of the following Common Core State Standards for English Language Arts:

- **CCSS.ELA-Literacy.RI.4.2**: Determine the main idea of a text and explain how it is supported by key details; summarize the text.
- **CCSS.ELA-Literacy.RI.4.4**: Determine the meaning of general academic and domain-specific words or phrases in a text relevant to a grade 4 topic or subject area.
- **CCSS.ELA-Literacy.RI.4.6**: Compare and contrast a firsthand and secondhand account of the same event or topic; describe the differences in focus and the information provided.
- **CCSS.ELA-Literacy.RI.4.9**: Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably.
- **CCSS.ELA-Literacy.SL.4.4**: Report on a topic or text, tell a story, or recount an experience in an organized manner, using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace.
Basic Teacher Preparation

Divide students into design teams of no more than four students per team. These design teams can be students’ teams for the duration of the project.

Present each team with a packet containing a Presentation Rubric (Appendix C), a piece of poster board, research materials (such as books, Internet sources, and so forth), and journals, which are used throughout the project.

Present a list of various types of engineers to the whole group. Each team picks a type of engineering to research.

This lesson requires students and teams to do research (preferably online), so access to a computer lab, cart, or laptop computers should be arranged ahead of time.

Ideally, on Day 2, students have the opportunity to engage in a conversation with an engineer invited to visit the classroom. In most communities, engineers are willing to come and discuss their work and the work of other engineers. The intent is for students to understand what engineers do and how they spend their days. Students should also understand the training necessary to work in such fields and the various types of engineering career paths found in most regions. If audio-visual tools (computer, overhead projector, and so forth) are needed for the engineer’s presentation, be sure to set them up ahead of time.

Required Preparation

- Gather or purchase all required materials for the lesson
  - Refer to the Materials List below
- Ensure that technology is available to project information from the recommended websites, or print and copy useful copies for students to place in their notebooks
  - Refer to the Suggested Teacher Resources at the end of this lesson
- Make arrangements to have an engineer prepare and give a presentation to the class

Materials List

<table>
<thead>
<tr>
<th>Item</th>
<th>Description/Additional Information</th>
<th>Quantity</th>
<th>Where to Locate/Buy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Science journal</td>
<td>Can be bound notebook paper or a spiral notebook</td>
<td>1 per student</td>
<td>Available in most schools</td>
</tr>
<tr>
<td>Poster board</td>
<td></td>
<td>1 per team</td>
<td>Available in most schools or at craft stores</td>
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Day 1: What Is Engineering?

Introduction (5 minutes)

Introduce students to the overall topic of engineering. Ask pairs of students to use a Know/Need to Know (N2K) chart about engineering.

<table>
<thead>
<tr>
<th>Know...</th>
<th>Need to know...</th>
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Give students several minutes to complete their Know/Need to Know chart, and then have students share their ideas with the whole class.

Mini-Lesson: What Is Engineering? (10 minutes)

Show the class one or both of the identified videos—NASA for Kids: Intro to Engineering and Celebrating Engineering at Boeing. Briefly discuss the videos, and, based on the information gleaned from them, ask students to add to the N2K chart.

Inform students that they are using the next two class periods to complete a mini-research project about the field of engineering and the various types of engineers. Review several types of engineers including:

- Aerospace engineer
- Chemical engineer
- Civil engineer
- Electrical engineer
- Mechanical engineer
- Computer Science engineer

Research Directions

Allow teams to choose the engineering career they want to learn more about. Alternatively, teams can draw from a cup, or engineering careers can be assigned to teams.

Each team researches its engineering career and selects the most valuable notes and information. At a minimum, students need to provide a clear description of the type of work their engineers do and explain the education or training needed. Encourage students to include several examples and to highlight the information they find most interesting.
Each team creates a brief 5-minute oral presentation summarizing their findings. Each member of the team should have a role in the presentation. Each team should create a related visual for their presentation on poster board.

Presentations are scored using the Presentation Rubric (Appendix C). Review the rubric when giving directions.

Mini-Lesson: Team Research (30 minutes)

Provide the teams with a starter list of possible research sites. (See the Suggested Teacher Resources at the end of Day 2.) However, you can also add to this list with materials from your school library or other websites you identify. Additionally, teams should be encouraged to do their own online research.

Teams work together to review sources, take notes, and organize information for their presentations.

Lesson Close (5 minutes)

Instruct teams to review the remaining tasks to prepare for their presentations in the next lesson. Assign homework tasks for members of the team as needed.

Helpful Tip
Consider simplifying the Presentation Rubric (Appendix C) for grade appropriate expectations and language.

CCSS Key Moment
Teachers may choose to adapt the research activity to emphasize certain Common Core State Standards over others.
Day 2: What Is Engineering?

**Introduction (5 minutes)**

Allow each team to assemble their materials and make any last-minute preparations for their presentations.

**Whole Group Discussion: Team Presentations (20 minutes)**

Have teams take turns giving their 5-minute presentations. Allow some time at the end for questions from the teacher and class. Use the Presentation Rubric (Appendix C) during and after each presentation.

**Whole Group Discussion: A Conversation with an Engineer (20 minutes)**

Introduce the guest speakers, and explain that they will be sharing information about the engineering field with the class.

The invited guests should give brief presentations focusing on their work life, education and training, and descriptions of typical work projects. If possible, the invited guests should try to connect their presentations to the engineering disciplinary core ideas.

**Lesson Close (5 Minutes)**

Ask each student to write a brief reflection in their science notebooks. They should list their most important observations and any questions they have about engineering.

**Assessment**

Several opportunities for formative assessment exist in this lesson:

- The mini presentations are a synthesizing activity and assessment artifact showing student understanding.
- Consider gathering evidence of student progress through small group and whole group discussions.
- Student contributions to the Know/Need to Know chart can be monitored.

**CCSS Key Moment**

If you are able to find invited guests, have students compare what they learned from a primary source (an invited guest) and a secondary source (their research), which will help them make progress on CCSS.ELA-Literacy.RI.4.6.
• Students’ reflections in their science notebooks should be regularly reviewed to inform instructional decisions.

Use the identified assessment opportunities to monitor student progress on disciplinary core ideas, science and engineering practices, and crosscutting concepts. Provide appropriate supports or extensions when necessary. Reference Appendix B for suggestions for meeting the needs of all learners.

Community Connections

Encourage students to embed any information they can find about local or regional engineers into their mini-presentations. The opportunity to bring a working engineer into the classroom ties the lesson back to authentic work in the community.

Suggested Teacher Resources

<table>
<thead>
<tr>
<th>Meeting the Needs of All Learners</th>
<th>Bolt Catcher Teacher Handbook, Appendix B</th>
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</thead>
<tbody>
<tr>
<td>Presentation Rubric</td>
<td>Bolt Catcher Teacher Handbook, Appendix C</td>
</tr>
<tr>
<td>NASA for Kids: Intro to Engineering (video)</td>
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<td>Celebrating Engineering at Boeing (video)</td>
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<td>Try Engineering</td>
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<td>Encyclopedia Britannica</td>
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