Edible Engineering Homeschool Lesson Plan

Raddish Lesson Plan Road Map

We design these lessons to be adaptable and flexible to your students and your life. You can do A Little Taste in ~45 minutes, or you can use the extension activities and make the projects and activities listed last over several lessons or even weeks. The lessons are meant to be interdisciplinary, covering many subject areas at once. Students of all ages can use these materials, with learners who are pre-writers able to draw or verbally share responses.

If desired, you could extend these lessons into a project-based learning unit of study, where students tackle a real world problem and create solutions. The learning happens in the process of getting to the presentation of the solution, and students often find it more meaningful when they are investigating a topic of their choice.

For a deeper look at the topic, A Big Bite offers extension ideas for learners who are able to read, write, and think on a higher level.

We always love to see your finished projects! You can share them in our Facebook group, The Raddish Table, or email us hello@raddishkids.com.

Driving Questions: What do engineers do? What are the concerns and focus of a structural engineer's work?

A Little Taste

Resource List

Background Information (also linked within lesson)

- *The Little Red Fort*, picture book by Brenda Maier, https://bookshop.org/books/the-little-red-fort/9780545859196
- *The Little Red Fort*, video read aloud by Readalotamus Books, https://www.youtube.com/watch?v=M5LFCZggG7I
- *The Science of Buildings: the Sky-Scraping Story of Structures*, picture book by Alex Woolf, https://bookshop.org/books/the-science-of-buildings-the-sky-scraping-story-of-structures-the-science-of-engineering/9780531133941
- Solve Problems: Be an Engineer, video from SciShow Kids, https://www.youtube.com/watch?v=D9I35Rqo04E
- What is Structural Engineering?, video from KQED Quest, https://www.youtube.com/watch?v=oqpp8L4J4ek
- Design Squad: Kid Engineer: The Design Process, video from PBS Kids, https://pbskids.org/video/design-squad-nation/2365668609
- STEM Kids Activity - Build Your Own Structures, video from STEM Little Explorers, https://www.youtube.com/watch?v=GS0ms32VsWE
- How We Design Buildings to Survive Earthquakes, video from Seeker, https://www.youtube.com/watch?v=c4fKBGsIIZI
- "Building Green", article by Jaime Joyce from TIME for Kids, https://www.timeforkids.com/g34/building-green-2/
- The Most Incredible Tiny Houses You'll Ever See, video from The List, https://www.youtube.com/watch?v=Hfgj_am_KUY

Optional Extensions

- *The Science of Bridges and Tunnels*, picture book by Ian Graham, https://bookshop.org/books/the-science-of-bridges-and-tunnels-art-of-engineering-science-of-engineering/9780531133996
- Bridges vs. Tunnels, podcast episode from Brains On!, https://www.brainson.org/episode/2015/08/26/bridges-vs-tunnels
- STEM Challenge: Build a Bridge, video from Lakeshore Learning, https://www.youtube.com/watch?v=g8mFuuyZC6A

- "The Most Famous Structures in the World", article form World Atlas, https://www.worldatlas.com/articles/the-most-famous-structures-in-the-world.html
- *If You Lived Here: Houses of the World*, picture book by Giles Laroche, https://bookshop.org/books/if-you-lived-here-houses-of-the-world/9780547238920
- "Biggest Animal-Made Structures in the World", article from Odd Culture, https://oddculture.com/biggest-animal-made-structures-in-the-world/

Conceptual Knowledge - What Do You Want Them to Know?

1. Engineering spans many different areas, but all engineers work to solve real world problems and improve people's lives in various ways.
2. Structural engineers work to create structures that are safe and serve a variety of different functions within our world.

Key Vocabulary

- Structural engineering - a speciality of engineering within civil engineering, where the focus is on design and safety of buildings and structures
- prototype - a simple model that lets you test out an idea
- sustainable building - design and construction that focuses on wasting as little energy and resources as possible

Cross-Curricular Links

- Science/Engineering, Language Arts, Math, Fine Art

Project Idea/Scenario

Create a structure that follows certain design parameters of safety and sustainability.

Plan the Process: What Will the Students Do?

Learn about the work of structural engineers, and then use that knowledge to design and build their own structures.

Warm-up Activity - Activating Background Knowledge

- Give students a deck of cards and ask them to build the tallest structure that they can using only the cards. Give students just a few minutes to complete their structures, and then introduce some sort of stress element to their structure. (Examples: "wind," an "earthquake," or use coins to see how much pressure the structure can withstand from various weights)
  - Reflect quickly: what were the challenges in constructing this? Had they ever built anything like this before?
- Explain that they were working and thinking like structural engineers, and the focus of this lesson will be on learning what they do and how they do it.

Sequence/Procedure

- Read or listen to *The Little Red Fort*. What is the process for constructing the fort?
  - Who was involved in the construction? What materials were used?
  - Have you made a fort or other kind of structure before?
    - Discuss: What was the hardest part? What materials did you use that worked? How strong was your fort?
- Check and see if your students already have a sense of what engineers and structural engineers do. Watch videos to learn specifically what engineers do and what structural engineers do.
  - How do they differ? In their own words, have students define what engineers do and the particular focus of structural engineers.
  - Who helped as the engineer in *The Little Red Fort*? What design or safety decisions were made?
  - What other qualities do you think engineers would need? What skills or character qualities did Ruby demonstrate in the story?
- Watch the structure design video and then complete the challenge. (You will need marshmallows or play dough, and toothpicks or straws.) After completing, reflect on the process and share your answers.
  - Did you start to build without coming up with a plan? How did your decision affect your design?
  - How strong is your structure? How safe is your structure?
    - If you would need to strengthen it, what would you add or do differently?
    - Could your structure withstand wind, or an earthquake? Have someone else shake the table under it and/or blow on it -- does your structure withstand the damage of these simulated natural disasters? Why or why not?
  - Building this simple structure could be an example of a prototype. With that information, can you explain what a prototype is? (Refer back to the vocabulary for the lesson for help.)
- Watch the design process video from PBS Kids. Using your knowledge from the design structure challenge and now the design process, take some time to fill out the graphic organizer on page 9 of the lesson plan for planning your own structure. Use the possible creations to choose a type of structure to create, and make sure to gather your materials before beginning to build.
- Share your structure while enjoying any of the recipes from Edible Engineering; can you eat your recipes inside your structure? Fill out the last question of the graphic organizer and reflect on your design and construction process.

Possible Creations

1. Design and build a fort to withstand the pressures of a natural disaster like an earthquake. Watch the video about earthquake design. Consider the foundation needed and identify what specific elements need to be considered before construction. Once you have completed your fort, you can invite someone to test its construction and see how well it can withstand its own simulated quake.
2. Sustainability is a consideration in construction. What materials could you use that are sustainable or recyclable? Read the article about how someone repurposed materials to use for construction, then construct your own fort that is only made up of recycled or reclaimed materials. If you do not have materials on hand, write out a plan of where you could source these materials nearby, and which materials would be best for constructing a treehouse or outdoor fort.
3. Tiny houses have become a new option from people who are looking for more affordable housing. Part of living in a tiny house is having built-in spaces that function in more than one way. Watch the video about tiny houses, then design one of your own. Create a model of your vision, and sketch out the ideas that you cannot construct with your own available materials but would want to include in final construction.

Extensions

1. To connect different areas or structures, civil engineers design and create bridges and tunnels. These types of structures use similar engineering concepts, but also need different kinds of supports. Read through the book *The Science of Bridges and Tunnels* and/or listen to the podcast from Brains On, and then create your own bridge using the video challenge from Lakeshore. How does bridge construction differ from building another kind of structure?
2. Take a look at different famous structures and houses from around the world. Use blocks or other building materials to create a small model of one of these houses or famous structures. What shapes make up the structures? If you use blocks, guess how many you will need for the structure, then count how many blocks you actually use. Have someone look at your completed structure and see if they can match it to its famous inspiration!
3. There are different structures in the world that were not designed by human engineers. Learn about some of them, then pretend you are one of the animal or insect builders. Use that point of view to write a list of suggestions of how a human structural engineer could incorporate some of your design ideas into their own structures. (Hint: you may need to conduct additional research to make your advice compelling and factual!)

Driving Questions: What is design thinking, and how can you use it as an engineer to solve everyday problems?

A Big Bite

Resources

- *Hello Ruby: Adventures in Coding*, picture book by Linda Liukas, https://bookshop.org/books/hello-ruby-adventures-in-coding/9781250065001
- Computer Science and coding for kids, video series from Sandy Elzner, https://www.youtube.com/playlist?list=PLtNMxxjuE_zKazEywHmYXQjmPrOT0T38R
- The Launch Cycle: A Design Thinking Framework for Education, video from John Spencer, https://www.youtube.com/watch?v=LhQWrHQwYTk
- Design Thinking podcast, podcast list https://fluidhive.com/design-thinking-101-podcast/
- Design Thinking Activities, list from STEM Family, https://www.stem.family/activities/design-thinking-activities/
- "Ten Kid Inventors Who Changed Our Lives", article from Inventionland, https://inventionland.com/blog/ten-kid-inventors-that-changed-our-lives/
- Hello Ruby Toothbrushing Algorithm, activity from Hello Ruby, http://www.helloruby.com/play/38
- "The Secrets Behind Your Grocery Store's Layout", article form Real Simple, https://www.realsimple.com/food-recipes/shopping-storing/more-shopping-storing/grocery-store-layout
- 9 Ways to Make Your Kitchen Work Harder - Without Remodeling, article from HGTV, https://www.hgtv.com/design/remodel/kitchen-remodel/ways-to-make-your-kitchen-work-harder-without-remodeling
- Kids Go Green: Reducing Food Waste, video from PBS Learning Media, https://hawaii.pbslearningmedia.org/resource/ee18-sci-foodwst/kids-go-green-reducing-food-waste/
- Sliced Bread, podcast episode from Stroke of Genius, https://www.ipoef.org/podcasts/sliced-bread/

Project Idea/Scenario

Use design thinking to create a process or product that improves someone's life in the area of food and cooking.

Sequence/Procedure

1. Read *Hello Ruby*, but stop before getting to the activities section of the book (page 68).
   a. The book title refers to "coding," but the text of the story does not refer to computers in any way. Why do you think that is?
   b. How familiar are you with computer coding and computer engineering? Browse through the videos about computers and see if you can now tell how Hello Ruby shows some of the thinking involved in computer coding.

2. A good framework for thinking about how a computer engineer (or any other kind of engineer) might begin a project is to look into design thinking. Watch the video about the launch cycle, browse the podcast list, and read about design thinking.
3. Read page 78 in *Hello Ruby* to understand algorithms and sequences, then complete Exercise 8 on page 80. Alternately, use the Toothbrushing Algorithm activity online and complete your own guide to toothbrushing.
   a. Identify the major pain points you need to be aware of when navigating Ruby's map (or when brushing your teeth). Would you be able to hand your written directions to someone else and get them to understand without explaining anything additional verbally?
   b. Are there any ways that you already use an algorithm that you didn't realize initially? (Think about all the technology you use daily, or specific instructions that you follow in the same order every time.)
   c. What other parts of your life might benefit from an algorithm? Consider who you might know whose life seems very ordered and sequential, and what systems they have in place to make things operate smoothly.
4. Read about some different kid inventors whose inventions changed our lives in small and big ways.
   a. Who can you identify from this list who used some concepts of design thinking?
   b. Who went through various stages of prototype development to get to the final design?
   c. Would you classify all of these inventors as engineers? Why or why not?
5. Read through the possible project creations and choose a project. Use the handout on page 10 of the lesson plan to use the design thinking process to come up with a prototype and test some possible solutions to your selected topic.
6. Share your completed project while enjoying any of the recipes from Edible Engineering. Test out your idea with your audience, and use their feedback to refine and reflect for the next version.

Possible Creations

1. Think about how your neighborhood grocery store is set up, and if you have a normal route that you follow when you enter the store. Read through the article about how a grocery store is typically laid out, and then consider the possible variables in your own life (e.g Does your store offer only groceries or also other items? Who does the shopping? What time and day of the week is the shopping done? etc.) Interview someone in your family about their specific issues with grocery shopping and what they wish was better or easier about it. Design a new grocery shopping route and approach that improves the experience for yourself, your family, or all users of the store.
2. Household chores are often a pain point for many families. There are many kitchen chores, including washing dishes, cleaning up after cooking and meals, and unloading groceries . Interview the members of your family who help with these chores, and read through the article about ways to improve your kitchen without renovation. Create a list of possible

solutions or a flowchart to make some of the common kitchen chores easier and even more enjoyable for everyone in the family. Implement your changes and see the effects on your family's chore system.

3. Food waste is a huge problem in the U.S. Watch the video from PBS Kids about food waste, and listen to the podcast from Stroke of Genius about food convenience inventions. What is the most wasteful part of your family's food consumption or purchasing? Research by interviewing anyone who participates in cooking and preparing food in your household, and then test out new strategies and systems to see if they measurably reduce food waste.

Structural Engineering Challenge

What is an engineer?

What is a structural engineer?

After choosing a specific project, consider:

What do you want your structure to be able to do, or what purpose does it serve?

Draw what you want it to look like:

After completing your structure, reflect and consider what worked well. What would you change for next time?

Design Thinking Process

1. **Empathy** – Who are you designing for, and what are the specific needs and pain points for that person or people?

2. **Define** – In simple words, what you are trying to create or do?

3. **Ideate** – Think of as many solutions and ideas as possible! Write down all thoughts, even if they seem silly or impossible.

4. **Create/Prototype** – Use available materials to make a first prototype. It does not need to be perfect! Use this space to write a brief description of your creation.

5. **Test/Show** – Give it to your user to try out, then record notes on the usability, safety, fun, stability, etc. of your prototype in action.

6. **Reflect** – What changes would you implement for your next iteration?