



Ignite K-12 STEM Learning with Free, Hands-On Design Activities



Design Challenge!

Create a prototype of sound canceling headphones to reduce the level of noise to protect hearing.



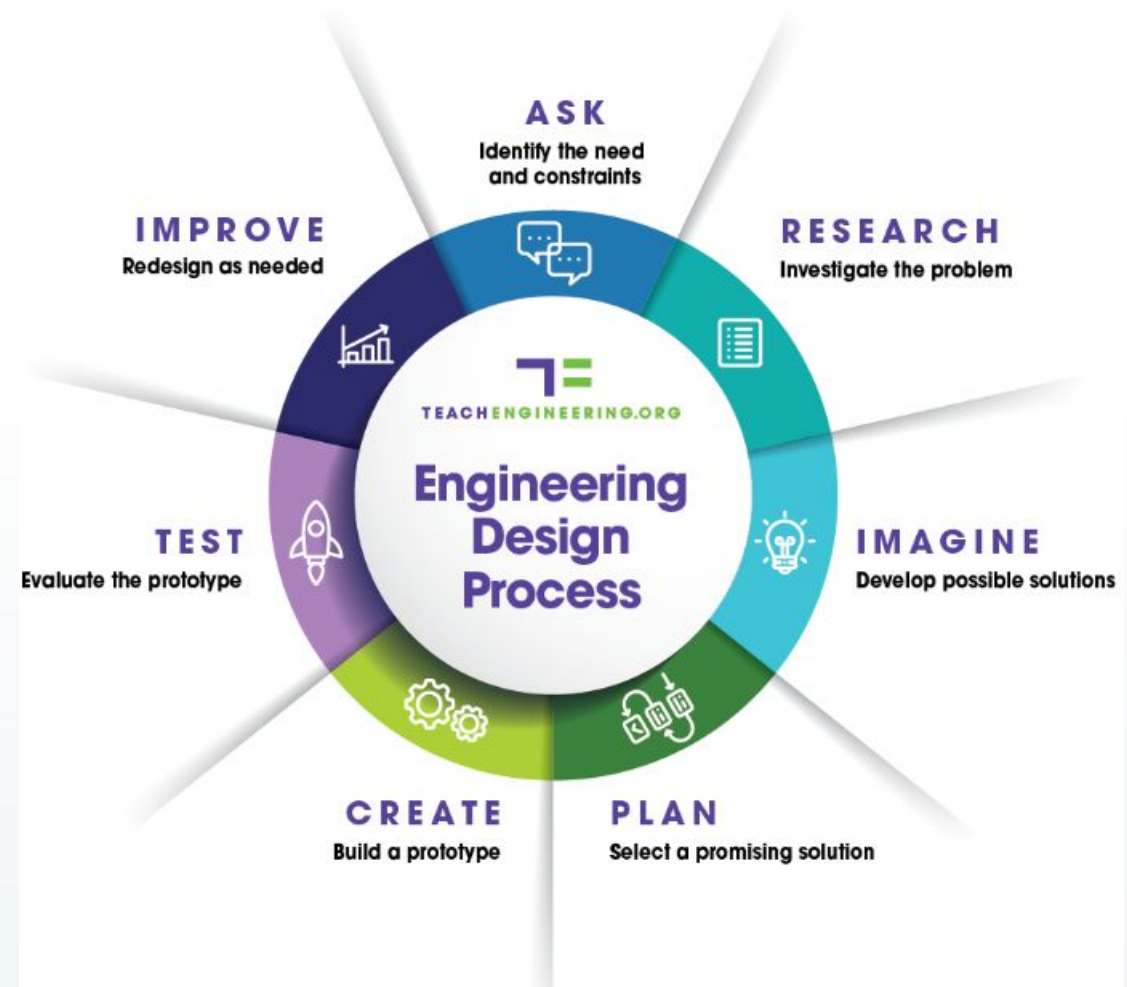
Images: <https://www.noisyplanet.nidcd.nih.gov/have-you-heard/musicians-face-higher-risk-of-hearing-loss>



Design Challenge

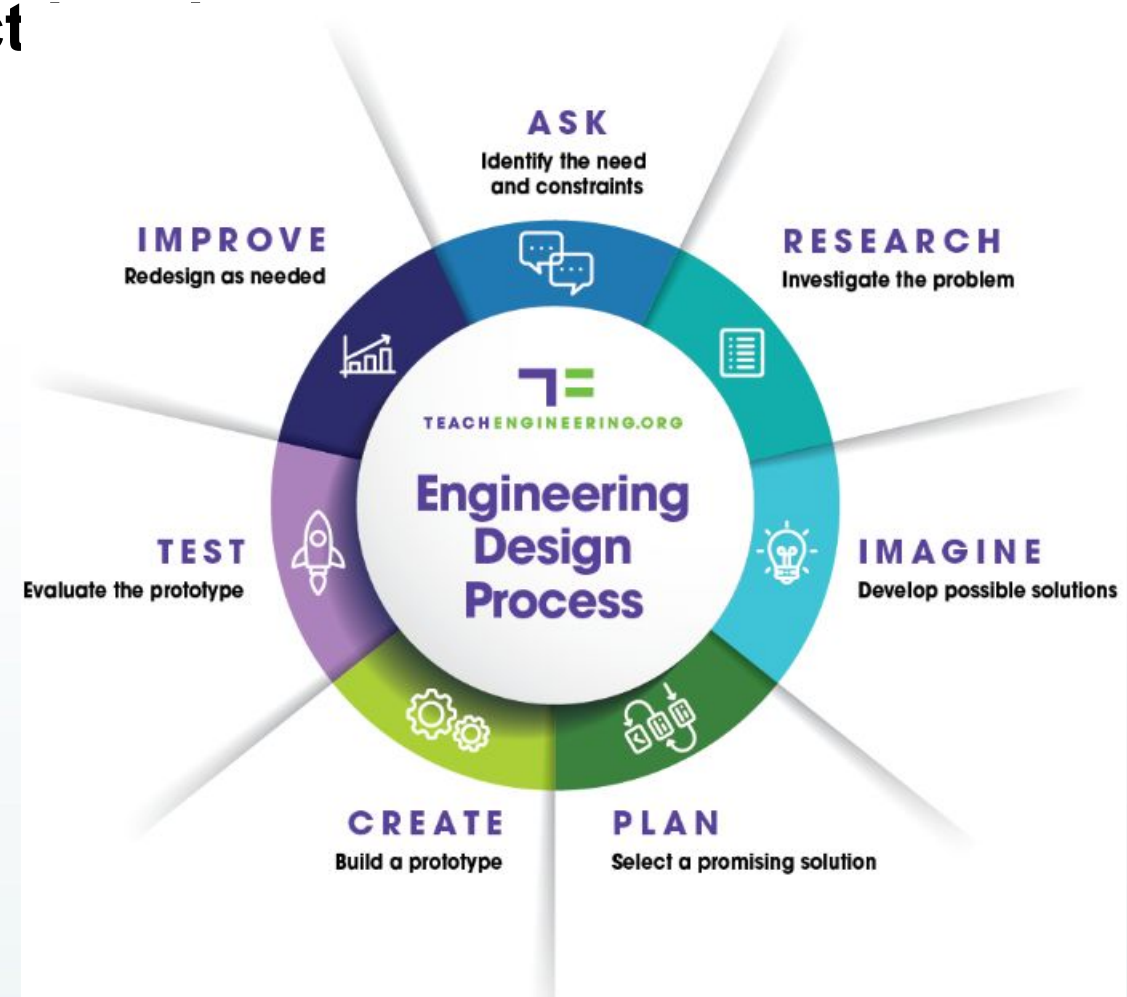
Rapid Prototyping

- **Goal:** Design-build-test a prototype model for sound cancelling headphones
- **Constraints (limits):**
 - Whatever materials you have on hand! (e.g, LEGOs, household & office materials, recycling etc.)
 - 6 minutes: 2 minutes to plan and 4 minutes to create and test your prototype!



Create a prototype of sound canceling headphones to reduce the level of noise to protect

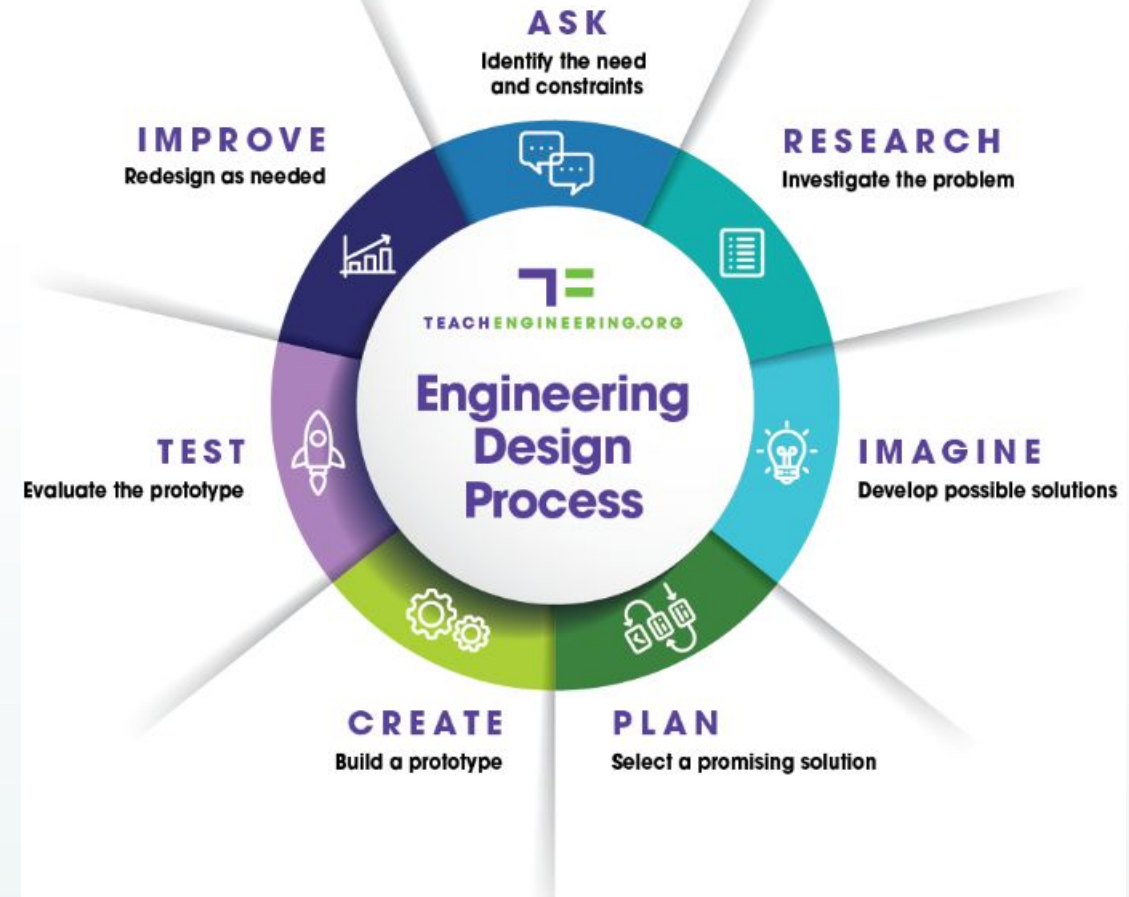
- **Imagine and Plan:** Brainstorm possible solutions and select the most promising one.



Create a prototype of sound canceling headphones to reduce the level of noise to protect

In 4 minutes:

- **Create and Test:** Build your prototype out of whatever materials around you. Get creative!



Share Out

- Share your designs!
- What materials did you use?
- How would you improve your designs?



HANDS-ON ACTIVITY

Controlling Sound

TeachEngineering > Activities > Controlling Sound



Quick Look

Partial design process

GRADE LEVEL: 4 (3 - 5)

TIME REQUIRED: 45 minutes

GROUP SIZE: 3

SUBJECT AREAS: [Physical Science](#)

NGSS PERFORMANCE EXPECTATIONS:

- [3-5-ETS1-1](#)
- [3-5-ETS1-2](#)
- [3-5-ETS1-3](#)

[Print this activity](#)
[Suggest an edit](#)
[Discuss this activity](#)

Share: [f](#) [t](#) [p](#) [e](#)

Summary

In this activity, students use a variety of materials to design and create headphones that absorb sound. Students apply steps of the engineering design process to identify a problem, develop possible solutions, select the most promising solution, create their prototypes, and test and evaluate their prototypes as well as make needed improvements.

This engineering curriculum aligns to Next Generation Science Standards (NGSS).



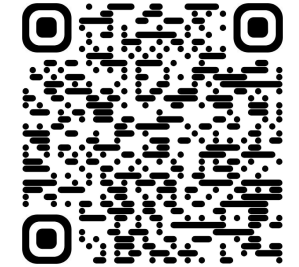
Students create headphones that absorb sound
copyright

Engineering Connection

Acoustical engineers study sound and design headphones that reflect and absorb sound to protect against hearing damage. In this activity, students are acting as acoustical engineers as they design headphones using

Curriculum in this Unit

- Sound and Light >
- Surf's Up! >
- Make Some Waves >
- Checking the Surf >
- Simon Says Big Amplitude, Small Wavelength! >
- Making Music >
- Simple Instruments >
- Plumbing the Deep - Using Sound Waves to See >
- Echolocation in Action! >
- To Absorb or Reflect... That is the Question >



What is Teach Engineering?

Teach Engineering is a FREE digital library of **classroom-tested, standards-aligned** K-12 STEM resources created in collaboration with educators across the nation.

Our goal is to **help educators put the 'E' in STEM** by making applied science, technology, and math come alive through engineering design and design thinking.



Teach Engineering K-12 STEM Digital Library

Accessible

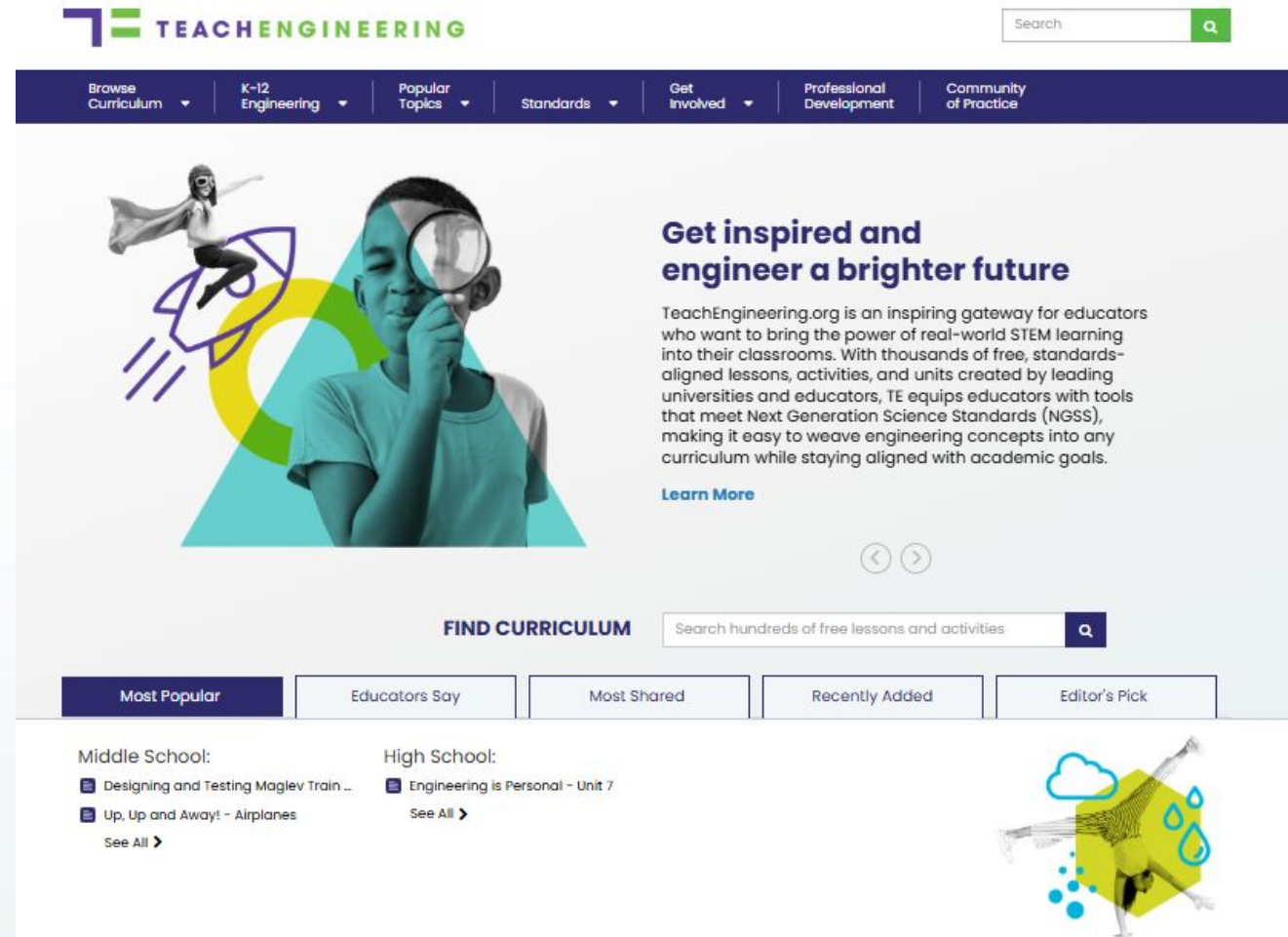
FREE collection of educational resources that uses **low-cost**, readily available materials.

Comprehensive

Over **2000 hands-on** activities, lessons, informal engineering activities, and maker challenges.

Teacher-tested; peer-reviewed

Resources have been **classroom tested** & reviewed by external educators and engineers.



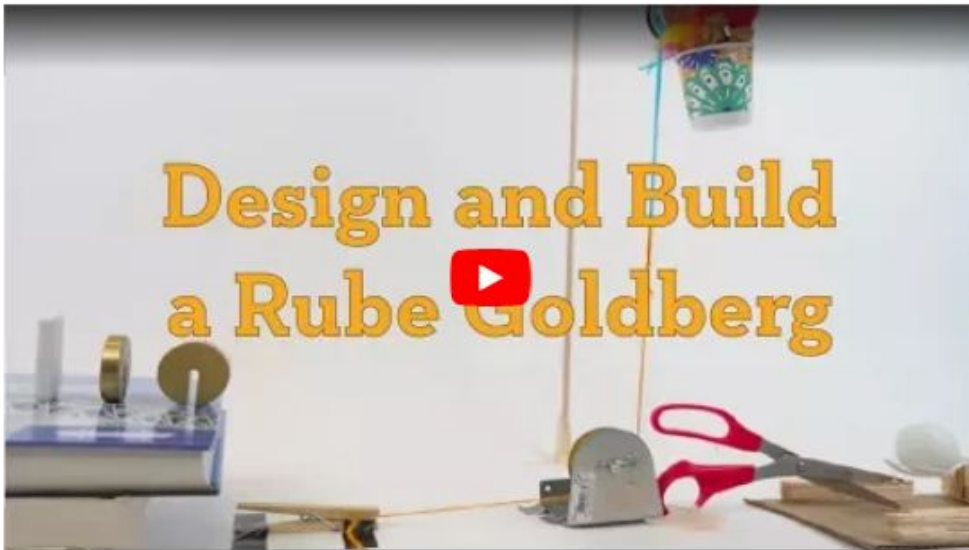
The screenshot shows the homepage of the Teach Engineering website. At the top, there is a navigation bar with the logo "TEACHENGINEERING" and a search bar. Below the navigation bar, there are several menu items: "Browse Curriculum", "K-12 Engineering", "Popular Topics", "Standards", "Get Involved", "Professional Development", and "Community of Practice". The main content area features a large image of a young boy looking through a magnifying glass, with a girl flying on a rocket in the background. To the right of the image, there is a headline "Get inspired and engineer a brighter future" and a paragraph of text describing the website's mission. Below the text is a "Learn More" link. At the bottom of the main content area, there is a "FIND CURRICULUM" section with a search bar and a "Search hundreds of free lessons and activities" button. Below this, there are five tabs: "Most Popular", "Educators Say", "Most Shared", "Recently Added", and "Editor's Pick". The "Most Popular" tab is selected, and it shows two categories: "Middle School" and "High School". Under "Middle School", there are two items: "Designing and Testing Maglev Train ..." and "Up, Up and Away! - Airplanes", each with a "See All" link. Under "High School", there is one item: "Engineering is Personal - Unit 7" with a "See All" link. In the bottom right corner, there is a small graphic of a person working on a yellow cube with blue water droplets and a cloud.

Teach Engineering K-12 STEM Digital Library

HANDS-ON ACTIVITY

TeachEngineering > Activities > Design and Build a Rube Goldberg

Design and Build a Rube Goldberg



Summary

In this two-part activity, students design and build Rube Goldberg machines. This open-ended challenge employs the engineering design process and may have a pre-determined purpose, such as rolling a marble into a cup from a distance, or let students decide the purposes.

This engineering curriculum aligns to Next Generation Science Standards (NGSS).

Quick Look

- Full design process
- Simple Machines
- Pulleys

GRADE LEVEL:	8 (7 - 9)
TIME REQUIRED:	1 hours 15 minutes Note: 25 minutes one day, 50 the next day
GROUP SIZE:	3
SUBJECT AREAS:	Physical Science Science and Technology
NGSS PERFORMANCE EXPECTATIONS:	MS-ETS1-1 MS-ETS1-2 MS-ETS1-4

Standards-Aligned

National and State Standards, including STEL, NGSS and others.

Turn Key

Full lesson details provided including learning objectives, materials lists, procedure, assessments, worksheets, rubrics and more!

Original How-To Videos

Helps teachers visualize how to execute engaging, hands-on activities in the classroom.

Engineering & Engineering Design Resources



- Browse Curriculum
- K-12 Engineering
- Popular Topics
- Standards
- Get Involved
- Professional Development
- Community of Practice

THE ENGINEERING DESIGN PROCESS



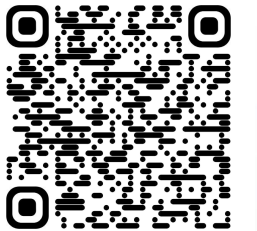
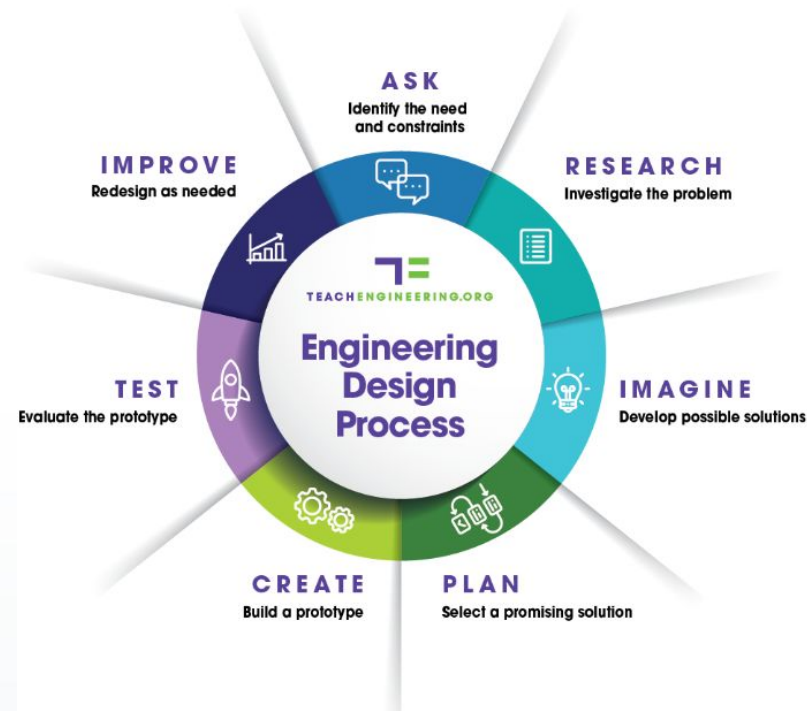
emphasizes open-ended problem solving and encourages students to learn from failure.

This process nurtures students' abilities to create innovative solutions to challenges in any subject!

The **engineering design process** is a series of steps that guides engineering teams as we solve problems. The design process is **iterative**, meaning that we repeat the steps as many times as needed, making improvements along the way as we **learn from failure** and uncover new design possibilities to arrive at great solutions.



Overarching themes of the engineering design process are **teamwork** and **design**. Strengthen your students' understanding of open-ended design as you encourage them to work together to brainstorm new ideas, apply science and math concepts, test prototypes and analyze data—and aim for creativity and practicality in their solutions. **Project-based learning engages learners of all ages—and fosters STEM literacy.**



DESIGN THINKING

Engineers use design thinking to creatively problem solve and innovate throughout the engineering design process.

Design thinking is a way of looking at and tackling real world problems that we experience in our everyday lives, and greatly need solutions for – especially the "wicked problems" that are not well defined or have clear answers, such as climate change.



Curated Popular Topic Resources



TEACHENGINEERING

Search

Browse Curriculum | K-12 Engineering | Popular Topics | Standards | Get Involved | Professional Development | Community of Practice

POPULAR TOPICS

Open up your students' minds with these wide-ranging popular topics and get ready to take a deep dive into real-life engineering explorations!

Curated hands-on K-12 STEM activities for educators' most popular topics.



NEWTON'S LAWS OF MOTION
help explain everyday phenomena that we see in the world around us.

Engineers use Newton's laws to navigate space travel, simulate vehicle collisions to improve safety measures and design simple devices like scissors!

A body at rest will stay at rest, and a body in motion will stay in motion, until acted upon by an outside force.

Force is equal to mass times acceleration. For an object with a constant mass (m), this law states that the force (F) is the product of an object's mass and its acceleration (a): $F = ma$.

For every action there is an equal and opposite reaction. This law is also known as the law of action and reaction.

Newton's Laws

Newton's Laws

Watch on YouTube

Engineers apply Newton's laws of motion in a wide range of designs involving stationary and moving objects, including structures such as bridges, vehicles such as rockets and aircrafts, and other commonly-used objects like seat belts, door knobs and medicine delivery systems.

Engineers must fully understand the workings of the natural physical laws so they can design objects that perform as expected and are safe to use.



Types of Engineering

Around the world, all types of engineers work together every day to help make communities and people healthy, happy and safe! From biomedical to agricultural engineers, all are creative problem solvers innovating solutions that shape our futures. Kids can take a closer look at the types of engineers below to learn what kind of work they do, and explore the featured hands-on activities that showcase each engineering type—for elementary, middle and high school students. And, check out our ["What is Engineering?"](#) video.

- Agricultural Engineers**
- Aerospace Engineers**
- Biomedical Engineers**
- Chemical & Biological Engineers**
- Civil Engineers**
- Electrical Engineers**
- Environmental Engineers**
- Mechanical Engineers**
- Software Engineers**

Agricultural Engineers

Making farms more efficient!

By integrating technological principles into food growing and processing agricultural engineers help farmers produce larger crop yields while improving sustainability. Agricultural engineering is involved with the food production chain, from developing seeds to designing and testing farm equipment. They also optimize transportation and storage.

Agricultural engineering spans many disciplines, but is generally broken into a few subfields: soil science, plant biology, organic chemistry, climatology and atmospheric science, along with engineering practices around equipment design, molecular optimization, and waste management.

Where do Agricultural Engineers Work?

- Agricultural engineers work in a variety of organizations, including:
- State agriculture extension programs
 - Foreign Agricultural Service (USDA)
 - Farm equipment manufacturers
 - Engineering consulting firms
 - Food processing companies

Explore our Agricultural Engineering Curriculum

- Grades 3-5:**
[Cutting Through Soil](#)
[Lab Experiments in Rebuilding Soil with Biochar](#)
[Plant Cycles: Photosynthesis & Transpiration](#)

Types of Engineering



Agricultural Engineering Info Sheet!
How will you change the world?

Agricultural Engineering

Making farms more efficient! By integrating technological principles into food growing and processing, agricultural engineers help farmers produce larger crop yields while improving sustainability. Agricultural engineering is involved with the food production chain, from developing seeds to designing and testing farm equipment. They also optimize transportation and storage.

Where do Agricultural Engineers Work?
 Agricultural engineers work in a variety of organizations, including:

- United States Department of Agriculture
- State agriculture extension programs
- Foreign Agricultural Service (USDA)
- Farm equipment manufacturers
- Engineering consulting firms

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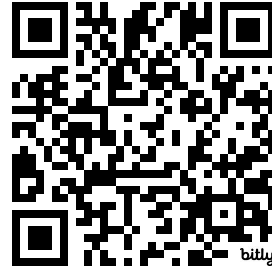
Explore Our Agricultural Curriculum
Grades 3-5:
 Cutting Through Soil
 Lab Experiments in Rebuilding Soil with Biochar
 Plant Cycles: Photosynthesis & Transpiration

Grades 6-8:
 Rooftop Gardens
 Soil Biosolarization: Using Waste & Sunshine to...
 Sun Keeps the Pests Away: How Soil Solarization...

What do Agricultural Engineers Study?
 A combination of many engineering disciplines, including environmental, civil, and chemical, agricultural engineering requires an understanding of a wide array of key principles. Agricultural engineers may study farming sciences such as soil science, plant biology, organic chemistry, climatology and atmospheric science, along with engineering practices around equipment design, molecular optimization, and waste management. Agricultural engineers also work on specialized projects that help grow their knowledge of the manufacturing involved in raising crops and animals for food and other consumer products.

Brought to you by the College of Engineering and Applied Science at University of Colorado Boulder.

Professional Development



Ready-made Webinars

Get a high-level overview of Teach Engineering. This is a great opportunity to learn more about the program and explore areas of interest, including how to engage students in engineering and [engineering design thinking](#).

Customizable Workshops

Explore the [engineering design process](#) and enhance your classroom with the Teach Engineering collection. Experience hands-on examples of our exemplar activities that utilize everyday materials. These offerings can be customized based on your interests, needs, and grade band. Various formats are available including in-person, virtual, and asynchronous delivery.

Teach Engineering Champions Institute

The Teach Engineering Champions Institute (TECI) is a 2-day, immersive program that blends hands-on exploration, collaboration, and reflection to create a dynamic professional learning experience.

Application for 2026 open now through March 15

[Champions Institute - Teach Engineering](#)



Teach Engineering YouTube Channel

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TEACHENGINEERING.ORG

TEACH CURIOSITY
PROMOTE PROBLEM SOLVING
AMPLIFY LEARNING

TeachEngineering

@TeachEngineering · 21.3K subscribers · 622 videos

Teach Engineering is a FREE digital library comprised of hundreds of standards-aligned, d...more

bsky.app/profile/teachengineering.org and 3 more links

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For You

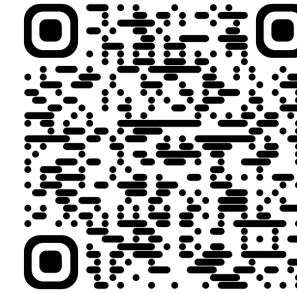
Helping Hands: Engineering Solutions for Multiple Sclerosis
213 views · 10 months ago

Exploring Light with Holographic Chocolate
285 views · 5 months ago

Pyramid Building: How to Use a Wedge
76 views · 8 days ago

The Dragging Dilemma: Overcoming Friction
48 views · 1 month ago

Popular videos



- 622 Videos
- 8.8M Views
- 21.3K subscribers

<https://www.youtube.com/c/teachengineering>

Classroom Impact

A middle school science teacher in TX said:

Teach Engineering's greatest strength lies in its ability to support teachers at all levels, from novice to expert. This program has been there to support my growth as an educator and my students' learning. Thanks to Teach Engineering, many of my STEM students have gone on to work as engineers in various fields, and I am confident that this program will continue to inspire and support future generations of engineers.

An elementary science teacher from FL said:

I created eight activities for TE that I have also implemented in my own classroom. Using TE for my students had multiple benefits: active engagement through authentic and meaningful problem solving, exposure to STEM pathways and careers, engaging in cross-curricular opportunities, and increasing their confidence to solve problems. As a teacher, TE provided me with: ready-to-go, curated lessons that do not require many resources, training and professional development leadership opportunities, cross-curricular and grade-level planning, connections, and a sense of confidence in teaching elementary science.



How can you use the Teach Engineering Digital Library:



CURRICULUM

Download and use thousands of free engineering lessons, activities, and how to videos.



REVIEW

Use your teaching and classroom experience to review incoming materials.



PUBLISH

Work with the editorial team to submit and publish original hands-on engineering activities.



PROFESSIONAL DEVELOPMENT

Learn more about engineering design, broadening participation in engineering, and how to use the digital library.



“Teach Engineering’s greatest strength lies in its ability to support teachers at all levels, from novice to expert. This program has been there to support my growth as an educator and my students' learning.”

- K12 STEM Educator

TRANSLATE THE RESEARCH

Participate in webinars specifically designed for the National Science Foundation’s Research Experiences for Teachers (RET) sites and Engineering Research Centers (ERCs) to learn how to translate educators’ research experiences into a K-12 engineering curriculum suitable for the collection. Email info@teachengineering.org for more info.



For more info visit

Get Involved with Teach Engineering!



Get Involved!

Sign up for our biweekly newsletter

<https://www.teachengineering.org/social/newsletter>

Like us on social media



TEACHENGINEERING.ORG

TEACH CURIOSITY + PROMOTE PROBLEM SOLVING + AMPLIFY LEARNING

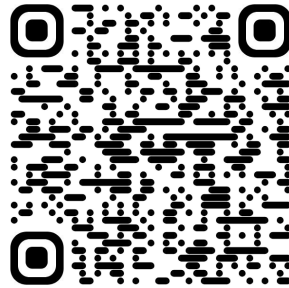
☀️ From Gratitude to Action

Thanksgiving gets us thinking about what we're grateful for and how we can give back. It's the perfect time to reflect on the many ways engineering makes our world a better place. From designing

Stay in Touch!

General Contact us:

teachengineering.org/about/contactus



Dua Chaker

Senior Project Engineer
dua.chaker@colorado.edu

dua.chaker@ncwit.org



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**Engineer a
brighter future**

THANK YOU

