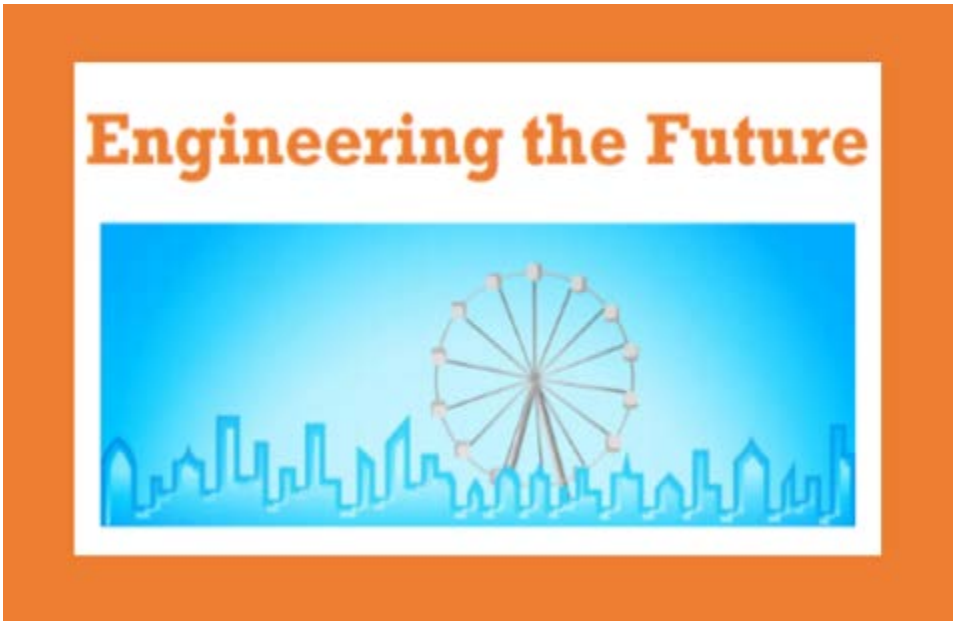
Career Exploration Unit



Grade 4-5

Standards:

Reading, Math, Science,

Fine Arts, Career Connections

Getting Started with This Lesson

Welcome to INFOhio's Career Exploration Units. These units contain multiple lessons that use INFOhio's digital resources to help students learn, practice, and master key learning standards while learning more about career options. In this lesson, students in grades 4 and 5 will learn more about jobs in engineering fields such as electrical, mechanical, aerospace and in science technology fields such as fuel cell technology and robotics.

By completing this lesson, your students will be able to practice some key technology skills, including:

- Click/Tap
- Scroll
- Drag and Drop
- Use a Video Player
- Drag/Slide

For more information on how to help your students practice technology skills visit INFOhio Tech Skills for Online Testing.

If you have any questions or comments, please go to support.infohio.org.

How to Access INFOhio Resources

INFOhio's license agreements require us to make sure that only Ohio's PreK-12 students, their parents, and educators can use the digital learning content.

We use IP recognition, cookies, and geo-authentication to make it easy for you to use our resources. If our system can automatically recognize that you should have access, you probably don't need to log in with a username and password.

If our system can't automatically recognize that you should have access, you can log in with your INFOhio username and password. You can find the INFOhio username and password for your school by visiting the INFOhio website and clicking Get Password in the blue box at the bottom of the page.

Best Practices for Digital Reading

Reading on a screen is different than reading print. The best practices in this guide were collected by the INFOhio Early Learning Task Force from journals, education publications, and research studies. Use these best practices with students of any age to help them become readers who can comprehend, analyze, and evaluate text on the screen or in a book.

- Best Practices for Digital Reading

Career Connections

Career Education

Each Career Exploration Unit includes one lesson focusing on careers within the theme to help children discover the variety of jobs available, connect the classroom to real-world situations, and develop work-readiness skills such as teamwork, decision making, and problem solving.

The Engineering the Future Unit focuses on the Engineering and Science Technologies Cluster. This includes technical and professional level careers in planning, managing, and providing scientific research services such research and development and careers in design, process, and development services such as electrical engineering, industrial engineering, materials science, nanofabrication, fuel cell technology, and robotics.

Job Focus

Engineer, Surveyors, Cartographers, Photogrammetrists, Astronaut, Geologist, Researcher, Astronomer, and other science fields.

Career Connections ODE Career Pathways

The Ohio Department of Education has created many Career Pathways that offer an overview of the options available within a career cluster. Each pathway provides information on the education or training needed, outlook for the careers, and wages. Below are some Career Pathways that will be of interest to students interested in working with design and engineering.

Electrical Engineering

Electronics Engineering

Engineering Management

Mechanical Engineering

Ohio Learning Standards

The INFOhio Career Exploration Unit Engineering the Future aligns with these Ohio Learning Standards for Reading. See Extend the Learning for additional activities aligned to other content area standards. This lesson address Ohio Learning Standards for Grade 4-5, but it is easily adapted for other grade levels.

Anchor Standard

Key Ideas and Details 1. Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.

Reading Literature

ELA-Literacy.RL.4.1 Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text.

ELA-Literacy.RL.5.1 Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text.

Reading Informational Text (Nonfiction)

ELA-Literacy.RI.4.1 Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text.

ELA-Literacy.RI.5.1 Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text.

Pretest

Use a large group informal setting to begin a discussion on engineering. Start with one or more of these questions to begin the discussion.
Are you curious about how things work? Do you love to solve problems? Would you like to explore the universe or study the different people who live on this planet? What about solving a math problem or creating a new design or structural innovation? If any of these topics interest you, then engineering may be the field for you. Share the brief video What is Engineering?. Use information from the video to help students to begin to explore the field of engineering.

Provide some guiding questions to help students begin to fill in the first two columns of a KWL chart. The questions might include:

- What is engineering?
- Why are engineers important?
- What kind of training and education do engineers need?

- How can engineering skills help you in everyday life?

Leave the L (learn) column blank until the post assessment. Be sure to leave the KWL chart visible throughout the study.

Post Test

Revisit the KWL chart. Have students share what they have learned. Record their answers in the "what we have learned" column of the original chart. As the answers are recorded, ask guiding questions that include:

- "How do you know?"
- Why is this important?"
- "How does this information affect your life?"

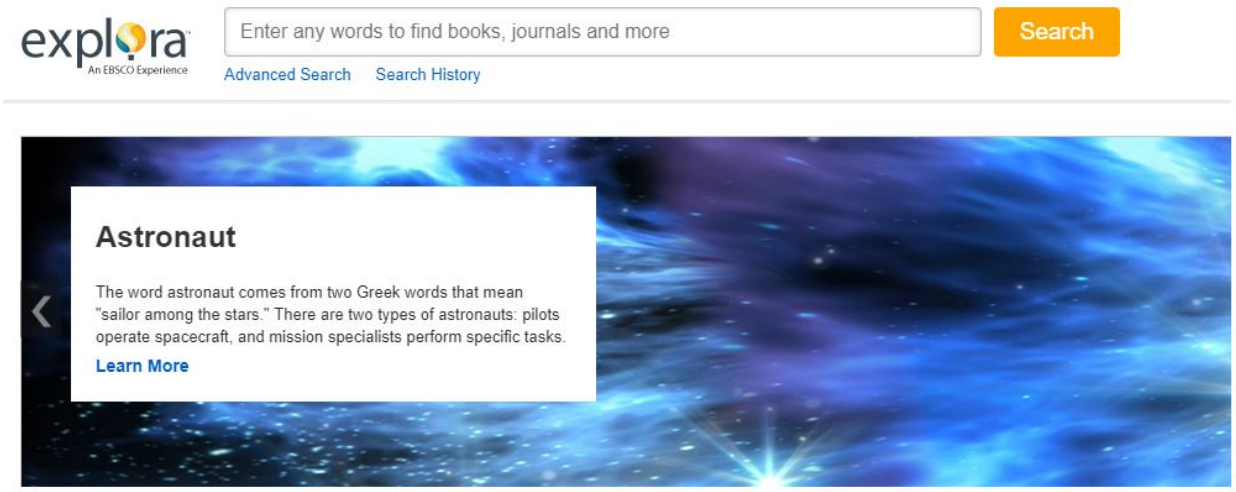
Cite examples from the texts and videos that support your answers.

KWL Chart.

Select a topic you want to research. In the first column, write what you already know about the topic. In the second column, write what you want to know about the topic. After you have completed your research, write what you learned in the third column.

What I **K**now	What I **W**ant to Know	What I **L**earned

Lesson 1: Building Bridges



INFOhio provides access to this collection of educational and trade publications at no cost for Ohio students, teachers, and parents. EBSCO's Explora for Grades PreK-5 contains full-text articles from magazines, journals, and newspapers.

Note on PDFs. Many of the articles in Explora are available in PDF format, which is a scanned image of the original article including pictures. Whenever possible, the PDF format is preferred. If you do not already have it on your computer, you can download free version of Adobe Reader.

For this lesson use the articles below:

- Brooklyn Bridge. *American History*. October 1, 2008. Lexile Reading Level:1090.
- Build a Bridge. *Cobblestone*. March 2010. Lexile Reading Level:1030.

You can access Explora for Grades PreK-5 using this link.

Activity

Civil engineers specialize in planning and supervising construction projects like bridges, tunnels, and highways to help traffic flow smoothly. One type of bridge that they plan and build is a suspension bridge. Read about a famous suspension bridge in the article Brooklyn Bridge. Click on the PDF link to see the pictures in the article. On a suspension bridge the weight of the deck is supported by vertical cables suspended from larger cables placed between towers. Try building a model of a suspension bridge using paper and cardboard. Follow the instructions in “Build a Bridge” and test your model for strength. Use the graphic organizer, "Suspension Bridge", to help plan and execute your model. (45-90 minutes)

Differentiation

The article is provided in two formats: HTML and PDF. If using the HTML, the text can be read aloud. By changing the settings, a large box pop ups on the screen as the text is read aloud. Click on the gear next to LISTEN to change the settings for enhanced visibility and pop-up. PDF is in a visual format that can be projected to a white board and shared and discussed with a large group or by individual students.

Suspension Bridge

The Brooklyn Bridge is a famous suspension bridge. Follow the instructions in the article "Build a Bridge" to build a model of a suspension bridge using everyday materials.

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Step	Outcome
Gather materials you need.	What did you need?
Build a suspension bridge model.	List the steps you did to make the bridge.
Test the bridge.	What happened when you tested the strength of the bridge?
Record results.	Draw a picture of your bridge, take a photograph, or share the model with your teacher and the class. Use another sheet of paper or attach the photo.

Assessment

The assessment can be completed individually or in a group setting. Use thumbs up for True and thumbs down for False or circle the correct answer. Point out where the answer can be found in the article.

True	False	1. The Brooklyn Bridge connects Brooklyn and Manhattan.
True	False	2. The bridge towers are made of marble.
True	False	3. the bridge was completed in 1906.
True	False	4. The bridge was the first suspension bridge to be made of steel cables.
True	False	5. The caissons were filled with cement to support the two bridge towers.

Answers: 1. True 2. False 3. False 4. True 5. True

Links for standards-based rubrics are listed below or create your own.

Iowa Core Standards Based Rubrics

Assessments and Rubrics (Kathy Schrock)

Read More About It

ISearch from INFOhio is the perfect place to read more about building bridges. Find reliable information with just one search. Use the tabs to find articles from encyclopedias, newspapers, magazines, and journals along with primary sources, videos, and eBooks at your reading level. Some suggested search terms include bridges, suspension bridges, bridges—design and construction, bridges—history, civil engineering, and the names of specific bridges such as Brooklyn Bridge or Golden Gate Bridge. For more about ISearch, view the Research Made Easy With ISearch Video.

Blockley, David. *Bridges: The Science and Art of the World's Most Inspiring Structures.*

Curlee, Lynn. *Brooklyn Bridge.*

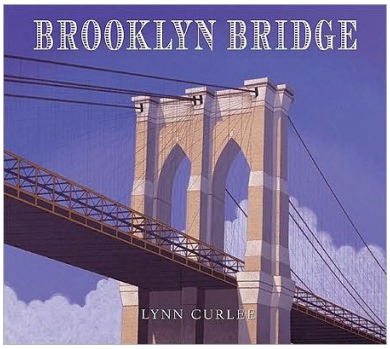
Johmann, Carol A. *Bridges! Amazing Structures to Design, Build & Test.*

Mann, Elizabeth. *The Brooklyn Bridge: The Story of the World's Most Famous Bridge and the Remarkable Family that Built It.*

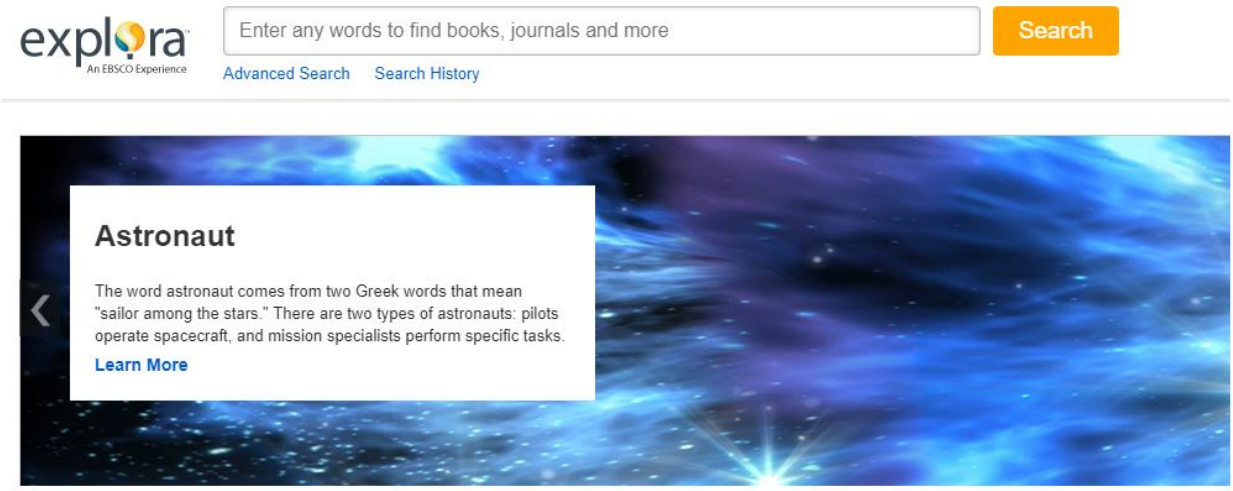
Ratliff, Tom.*You Wouldn't Want to Work on the Brooklyn Bridge!*

Stine, Megan. *Where is the Brooklyn Bridge?*

Tomasi, Peter J. *The Bridge: How the Roeblings Connected Brooklyn to New York.*



Lesson 2: Mighty Machines



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Note on PDFs. Many of the articles in Explora are available in PDF format, which is a scanned image of the original article including pictures. Whenever possible, the PDF format is preferred. If you do not already have it on your computer, you can download a free version of Adobe Reader.

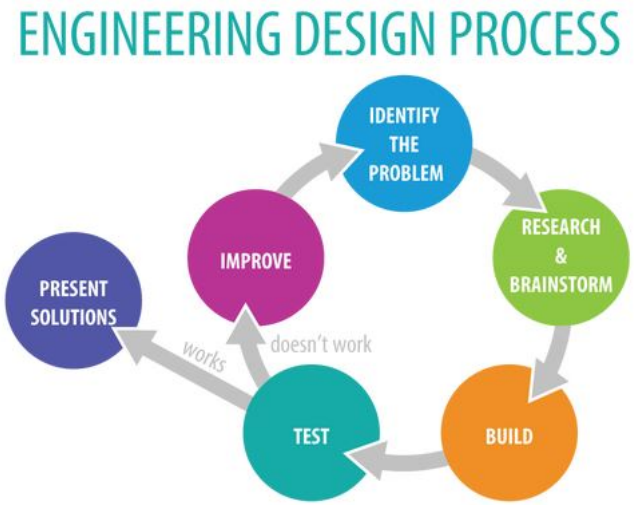
For this lesson use the article below:

One Crazy Device. *Scholastic Super Science*. Mar. 2017. Lexile Reading Level: 1010.

You can access Explora for Grades PreK-5 using this link.

Activity

Read and Discuss



Share the article One Crazy Device about Rube Goldberg, a cartoonist, engineer, sculptor, and author who drew inventions in his cartoons that have inspired engineers and scientists around the world. A Rube Goldberg machine performs a simple task in a complicated way. Share some of his cartoon inventions along with some of the entries in the annual Rube Goldberg contest. Have students design their own Rube Goldberg machine to do one task like knocking over a cup or turning on a light. Discuss the Engineering Design Process from Smartspace@NIU. Use the graphic organizer, "Create a Rube Goldberg Contraption," to design your contraption and share with the class. (45-90 minutes)

Create a Rube Goldberg Contraption

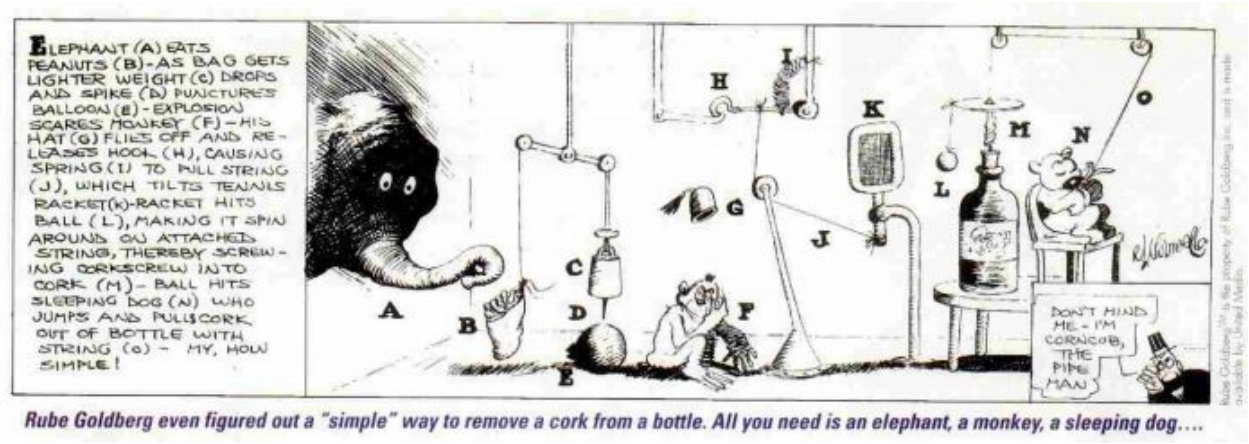
Rube Goldberg was an engineer and cartoonist who created over 3000 a-maze-ing inventions in his lifetime. He loved to draw zany, complex devices to complete very simple tasks like brushing off clothes and removing unwanted guests from your home. It is your turn to design a "Rube Goldberg" to solve a simple task like knocking over a cup or turning on a light. Use the chart to help you plan.

Step	Result
Identify the Problem Example: Turning on the light	
Research & Brainstorm What materials will you need? How will you solve the problem?	
Build Goldberg drew cartoons showing how to build his contraptions. Instead of actually building the invention, draw it and show how it will work. Use another piece of paper if you need it.	
Test What possible things could go wrong?	
Improve (If doesn't work) How would you make improvements? Draw them or write about them in the next box.	
Present solutions Draw a version of your final contraption on a separate sheet of paper or actually build it and share with the class.	

Differentiation

The article is provided in two formats: HTML and PDF. If using the HTML, the text can be read aloud. By changing the settings, a large box pop ups on the screen as the text is read aloud. Click on the gear next to LISTEN to change the settings for enhanced visibility and pop-up. PDF is in a visual format that can be projected to a white board and shared and discussed with a large group or by individual students.

Assessment



Rube Goldberg even figured out a "simple" way to remove a cork from a bottle. All you need is an elephant, a monkey, a sleeping dog....

After reading and discussing the article, ask the students to answer the following questions. Use evidence from the text to support the answer.

True False 1. Rube Goldberg was an aerospace engineer.

True False 2. Goldberg never actually invented anything useful.

True False 3. The game “Mousetrap” is based on one of Goldberg’s inventions.

True False 4. The National Rube Goldberg Machine is held each year at the University of San Francisco.

True False 5. Rube Goldberg created more than 3000 contraptions.

Answers: 1. False 2. True 3. True 4. False 5. True

Links for standards-based rubrics are listed below or create your own.

Iowa Core Standards Based Rubrics

Assessments and Rubrics (Kathy Schrock)

Read More About It

ISearch from INFOhio is the perfect place to read more about mighty machines and engineering. Find reliable information with just one search. Use the tabs to find articles from encyclopedias, newspapers, magazines, and journals along with primary sources, videos, and eBooks at your reading level. Some suggested search terms are inventions, engineering, inventors, or the names of specific inventions. For more about ISearch, view the Research Made Easy With ISearch Video.

Also try:

Beaty, Andrea. *Ada Twist, Scientist.*

Beaty, Andrea. *Rosie Revere, Engineer.*

Miller, Reagan. *Engineering in Our Everyday Lives.*

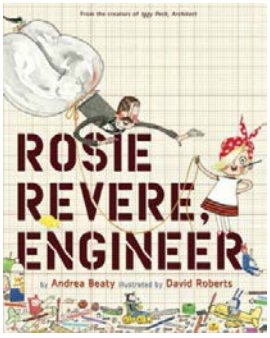
Paris, Stephanie. *Engineering Feats and Failures.*

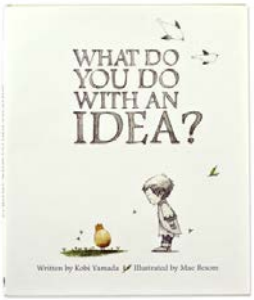
Reynolds, Peter. *Going Places*.

Spires, Ashley. *The Most Magnificent Thing.*

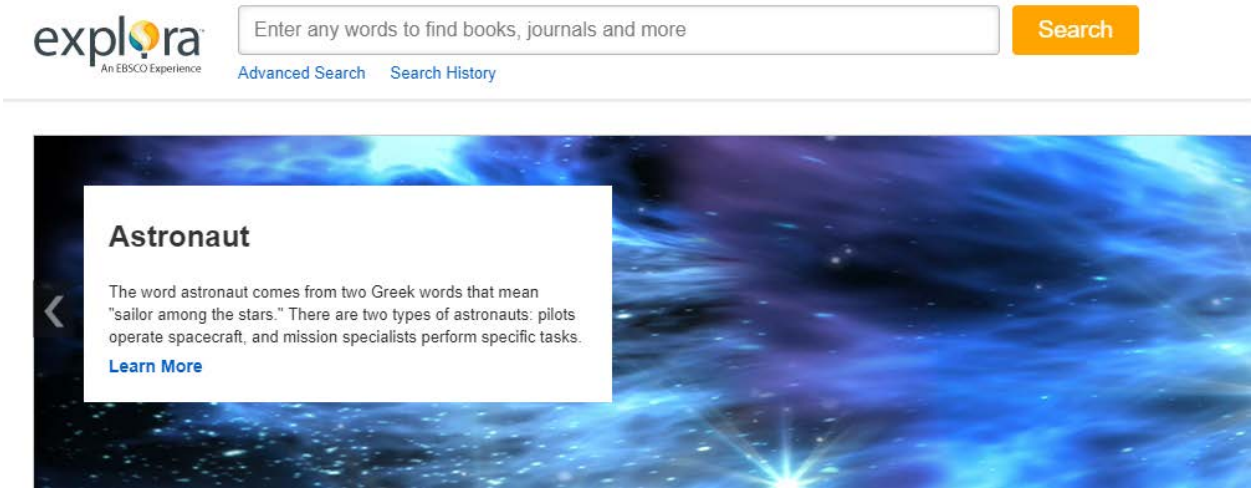
Yamada, Kobi. *What Do You Do with an Idea?*

Yamada, Kobi. *What Do You Do with a Problem?*





Lesson 3: Engineering Fun



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For this lesson use the articles below:

- Wheels in His Head. *Highlights*. Jun. 2002. Lexile Reading Level: 940.
- HeAds Up. *Boys' Life*. Aug. 2013. Lexile Reading Level: N/A.

You can access Explora for Grades PreK-5 using this link.

Activity

Read and Discuss

Every year thousands of people head to amusement parks to experience scary roller coasters, high Ferris wheels, slippery water slides, and other attractions, all of which have been designed by engineers. Engineers use science and technology to design and build engines, machines, and structures including the rides at amusement parks.

Read about the first Ferris wheel and its inventor in Wheels in His Head. Then read the fast facts about some famous Ferris wheels from the article HeAdS Up. Based on the information that you read, design a Ferris wheel for your hometown. Include a drawing along with a brief description of the materials that you will need and the stages of

construction. Use the graphic organizer, “Design a Ferris Wheel,” to help as you as you work on your design.

Design a Ferris Wheel

Name _____

Now that you know more about Ferris wheels, see if you can design one for your hometown. Draw your plan for the Ferris wheel in the box and then complete the questions.

Name of Ferris Wheel
Description of the Ride
Stages of Construction
Materials Needed

Differentiation

The article is provided in two formats: HTML and PDF. If using the HTML, the text can be read aloud. By changing the settings, a large box pop ups on the screen as the text is read aloud. Click on the gear next to LISTEN to change the settings for enhanced visibility and pop-up. PDF is in a visual format that can be projected to a white board and shared and discussed with a large group or by individual students.

Assessment

Cite or point to the place in the texts where the answers can be found.

True False 1. The Ferris Wheel made its first appearance at the Chicago World's Fair in1893.

True False 2. The Big-O Ferris wheel is the only one built directly over a river.

True False 3. Ferris invented a mechanical marvel that weighed more than 2 million pounds.

True False 4. The Tianjin Eye Ferris wheel has no center axle.

True False 5. The cost for a ride on the original Ferris Wheel was 50 cents.

Answers: 1. True 2. False 3. True 4. False 5. True

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Iowa Core Standards Based Rubrics

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Read More About It

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Also try:

Alter, Judy. *Amusement Parks: Roller Coasters, Ferris Wheels and Cotton Candy.*

Glatzer, Jenna. *George Ferris' Grand Idea: The Ferris Wheel.*

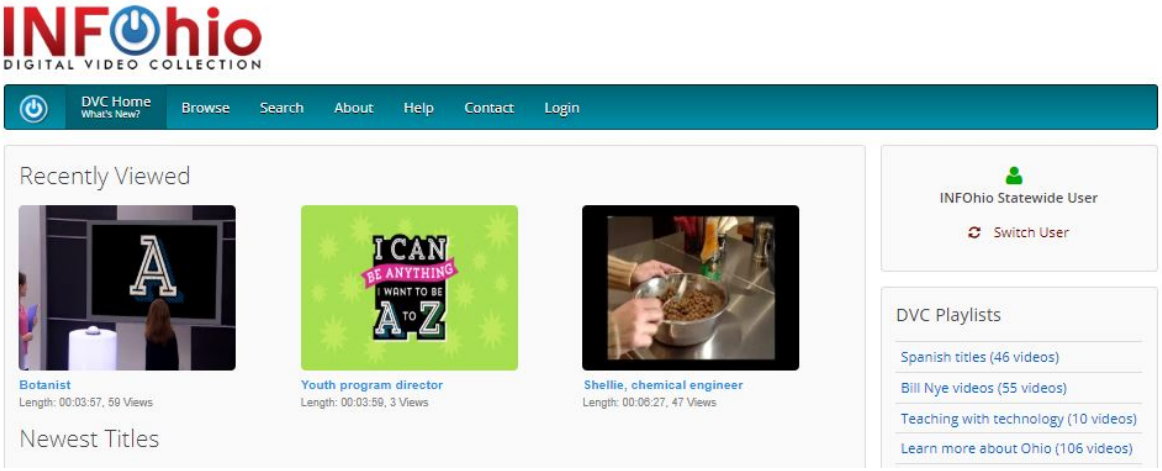
Greathouse, Lisa. *How Amusement Parks Work.*

Kraft, Betsy Harvey. *The Fantastic Ferris Wheel: The Story of Inventor George Ferris.*

Mitchell, Susan K. *Amusement Park Rides.*

Thaler, Mike. *The Amusement Park from the Black Lagoon.*

Lesson 4: Careers in Engineering and Science Technologies



INFOhio provides access to this collection digital videos at no cost for Ohio students, teachers, and parents. This collection of streaming educational videos supports all curriculum areas and Ohio's Learning Standards. The videos are segmented and downloadable with teacher guides for most of the collection.

For this lesson use:

INFOhio Digital Video Collection (DVC). Series: Engineering the Future.

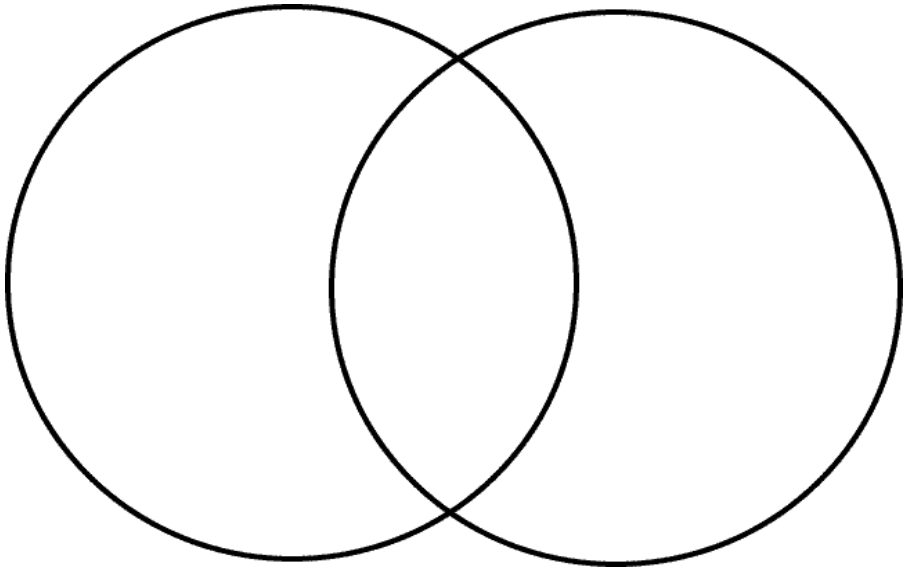
Activity

Read and Discuss

Use the INFOhio DVC (Digital Video Collection) to watch the series Engineering Your Future. (Click on the link, select search, and perform a series search on Engineering Your Future.) Each video is a profile of an engineer telling their story and answering questions about their field. Watch two of the short videos about different engineers. Be sure to read the short summary of the video first. Use the questions on the chart to help you take notes as you watch the interviews. Then use your notes to compare and to contrast the two videos on the Venn diagram. (45-90 minutes)

Compare/Contrast

Use your notes to compare and contrast the two videos on the Venn diagram.



Video Notes

Directions: Use the questions to help you take notes as you watch the interviews.

Question	Answer: Video 1	Answer: Video 2
What type of engineer was featured?		
What kinds of projects does the engineer do?		
What are some of the skills that the engineer needs?		
What are some of the challenges that the engineer faces?		
What tools does the engineer need?		
What would you need to study to become this type of engineer?		
What courses in high school are important for this career?		
Is college needed for this career? If so, how much?		
Does this engineer work alone or in teams?		
What are some of the career opportunities for this engineer?		

Differentiation

Video can be used to provide visual reinforcement and enhancement to printed materials. The short interviews in this series include a brief summary to share with students before viewing and listening to the engineers.

Assessment

The assessment can be completed individually or in a group. Choose True or False for each statement. Cite the place in the text where you can find the answer.

True False 1. Chemical engineers develop a wide range of chemical-based products.

True False 2. Engineers use science to design structures, machines and products.

True False 3. Tara is the robotics engineer who deals with electrical systems.

True False 4. Civil engineering is about building structures.

True False 5. Biomedical engineers work with health-related problems.

Answers: 1. True. 2. True 3. False 4. True 5. True

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Extend the Learning

Ohio Learning Standards. Writing.

Text Types and Purpose 2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.

ELA.W.4.2 and ELA.W.5.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly.

ELA.W.4.3 and ELA.W.5.3 Write narratives to develop real or imagined experiences or events using effective technique, descriptive details, and clear event sequences

Extension Lesson: If you enjoy wild rides and heart pounding adventures, just visit any amusement park. The rides get scarier every year. Read more about these Scream Machines (*Scholastic SuperScience*. May 2008. Lexile 940). Choose one of the machines from the article and write a story about your make-believe adventure on it. Be sure to include information from the text in your story. (30-60 minutes)

Ohio Learning Standards. Math.

Measurement and Data

Grade 4: Represent and interpret data Grade 5: Represent and interpret data.

Extension Lesson: Every child can be an engineer with some trial and error. Experimenting helps students develop logic skills that are important in daily life. Set up a tinkering station with all sorts of odds and ends like tape, adhesives, cardboard, rubber bands, string, ruler, etc. Include journaling pages so that students can record their ideas and data. For some great ideas on tinkering, see the INFOhio Pinterest boards on Makerspaces. with links to dozens of lessons and activities. (30-60 minutes)

Ohio Learning Standards. Science.

Grade Band Theme: Interconnections within Systems: Science Inquiry and Application.

Grade 4. During years of PreK-4 all students must become proficient in the use of the following scientific processes, with appropriate laboratory safety techniques to construct their knowledge and understanding in all science content areas.

- Observe and ask questions about the natural environment.
- Plan and conduct simple investigations.
- Employ simple equipment and tools to gather data and extend the senses.
- Use appropriate mathematics with data to construct reasonable explanations.

- Communicate about observations, investigations and explanations.
- Review and ask questions about the observations and explanations of others.

Grade 5: During the years of grades 5-8, all students must use the following scientific processes, with appropriate laboratory safety techniques, to construct their knowledge and understanding in all science content areas:

- Identify questions that can be answered through scientific investigations.
- Design and conduct a scientific investigation.
- Use appropriate mathematics, tools and techniques to gather data and information.
- Analyze and interpret data.
- Develop descriptions, models, explanations and predictions.
- Think critically and logically to connect evidence and explanations.
- Recognize and analyze alternative explanations and predictions.
- Communicate scientific procedures and explanations.

Extension Lesson: Aerospace engineers design, test, and analyze all types of aircraft. They learn all about aerodynamics, mechanics, and construction materials. Building a kite is a good way to learn more about design, construction, and flight. Follow the directions in Build It! (*Boys' Life*. Mar 2000. Lexile: 505) to test your skills at design and construction. How could you modify your kite to make it lighter, spin, or get more control? (30-60 minutes)

Ohio Learning Standards. Fine Arts.

Visual Arts - Producing/Performing.

Grade 4: Experiment with art materials by using them in unexpected and creative ways to express ideas and convey meaning.

Grade 5: Use digital tools to explore ideas, create and refine works of art during the art making process.

Extension Lesson: Are you creative and like to build things? Then maybe an amusement park ride engineer is a career choice for you. Read more about the job, education and more in the article Amusement Park Ride Engineer Job Description. Make a digital poster about amusement park ride engineers using programs such as PosterMyWall, Canva, or even Microsoft Office. (30-60 minutes)

Here is a sample poster (created in PosterMyWall):

Additional Resources

- INFOhio Educator Tools

  For additional assessments, instructional strategies and resources, and cross curricular connections by standard, go to INFOhio's Educator Tools.

- INFOhio Pinterest

  Looking for more resources about "Engineering the Future." Check out INFOhio's Pinterest board.