THE TRAILBLAZER IS COMING YOUR WAY!

The Trailblazers are 40-foot exhibit trailers that house a variety of engineering and science exhibits targeted at students in grades 3 to 8. As they travel across the state, the Trailblazers engage students, teachers and parents through **hands-on activities and exhibits** that highlight fundamental concepts in science and engineering. Trained volunteers provide explanations and demonstrations of all the exhibits. Since all the exhibits are **mapped to specific science TEKS for grades 3 – 8**, teachers can easily incorporate the exhibits into their lesson plans and provide students with an opportunity to go on an in-school field trip. You will receive follow up material to extend the learning experience into your classroom!

Below is an activity you can do before the Trailblazer arrives to introduce engineering and the Engineering Design Process to your students.

PRE LESSON: CLASSROOM ACTIVITY

Engineers and the Engineering Design Process**

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Ask students:

What do you think an engineer is or what is engineering?
What do you think of when you hear the word engineering?

Answer:

Engineering is not usually considered a science. Science is about discovering the natural. Engineering is creating the artificial.
Engineers apply the principles of science and mathematics to develop solutions to problems. Math and science classes are both basic to engineering. Engineers use math and science to invent, design, and build things. They are team players with independent minds who ask, "How can we develop a better recycling system to protect the environment, design a school that can withstand an earthquake, or create cutting-edge special effects for the movies?" By dreaming up creative and practical solutions, engineers are changing the world all the time.

Show your class the picture of the picnic scene.

Break them into small groups and have them come up with 5-10 items that have been engineered in the picture. Challenge your students to think beyond the typical.

Or as a class, make a list of the items that have been engineered. Give the groups about 10 minutes to come up with their answers. Then have each group in turn list all the items they came up with.

Some examples: (bold are commonly missed)

- Playground, building, fence, bike, helmet, cell phone, cooler, pop can, **pop**, water bottles, **apples**, sunglasses, football, chair, sandals, watch, **clothes**.

Almost everything in the picture has been engineered.

TYPES OF ENGINEERS

Engineering has been called the "invisible" or "stealth" profession. Everything around you and that you use every day has been engineered in some way, yet you rarely hear about the work of engineers. There are many types of engineering. (The italicized sentences are teacher information.)

The four main branches are:

Chemical
Civil
Electrical
Mechanical

Other branches of engineering include aerospace, biomedical, environmental, and manufacturing.

- **Chemical engineers**

  Chemical engineers work with chemicals to convert basic raw materials into a variety of products such as:

  - plastics
  - paints
  - fuels
  - fibers
  - medicines
  - fertilizers
  - paper

  Chemical engineers also play an important role in protecting the environment by inventing cleaner technologies.

- **Civil engineers**

  Civil engineers oversee the construction of the buildings and other structures that make up our world:

  - highways
  - skyscrapers
  - railways
  - bridges
  - water reservoirs

- **Electrical engineers**

  This is the largest field of engineering. Electrical engineering is the study and application of electricity, electronics and electromagnetism:

  - huge power grids that light up cities
  - devices smaller than a millimeter that tell a car's airbags when to inflate
  - cell phones
  - digital cameras
  - roller coasters
  - medical testing equipment
  - communications systems

- **Mechanical engineers**

  Mechanical engineers work in nearly every area of technology. If an object or system has a moving part, it has benefited from the influence of a mechanical engineer.
  Mechanical engineers might develop:

  - a bike lock
  - an aircraft carrier
  - a child's toy
  - a hybrid car engine
  - a wheelchair
  - a sailboat

Engineering Design Process

- Engineers use a design process. It helps them stay focused and on track when developing a product or a solution to a problem.
- The main steps are:
    1. **Identify the Problem-** Describe the challenge to be solved, including limits and constraints.
    2. **Explore-** Research what others have done. Discover what materials are available.
    3. **Design -** Use your knowledge and creativity to come up with many solutions. Choose one idea and draw or make a model of it.
    4. **Create -** Make your solution.
    5. **Try It Out -** Test your solution.
    6. **Make It Better -** Evaluate how the solution worked and think of how to improve your design. If needed, go back to step 4 and make changes.

Example of the Engineering Design Process

- **Identify the Problem:** Make a new running shoe.
  Constraint: Made only of recycled materials
- **Explore:** Find out what other companies are doing to use recycled parts. What materials are they using, how are they finding the materials, and what part of the shoe are they using them for.
  Example: KEDS is making a shoe with recycled rubber from tires,organic cotton and shoelaces made from recycled water bottles.
- **Design:** Sketch and model various solutions, describing what each part is made of and how it will be transformed into a part of the shoe.
- **Create:** Make the best solution from your models
- **Try It Out:** Do tests with target audience (*e.g. runners and athletes*) and get their feedback.
- **Make It Better:** Evaluate the feedback and make changes.

We are looking forward to your visit to the Trailblazer!!
The Texas Alliance for Minorities in Engineering will send you follow up activities to extend the learning experience into your classroom!

If you are interested in more information about starting a TAME club or participating in the Math and Science Competition please contact us at programs@tame.org

**This activity was created by The Works Museum in Minnesota 2013
www.theworks.org