

K-12 ENGINEERING

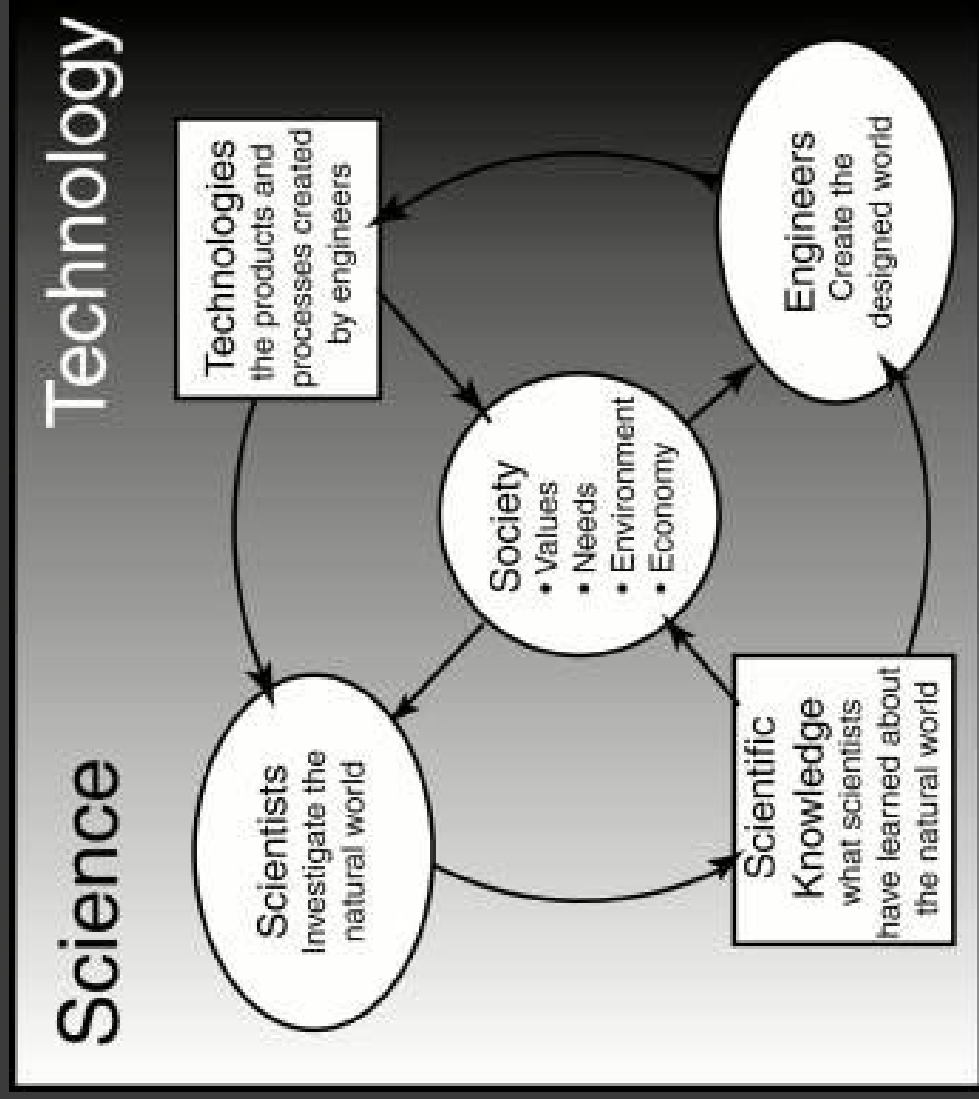


What is K-12 engineering???

- Design problem solving
- Integrates learning from the arts, science, technology, and mathematics
- Authentic, real-world contexts
- Hands-on tasks and activities
- Student-centered learning



What is the difference between engineering, science, and technology?



In the real world, these disciplines are closely connected. Scientists often use technologies created by engineers to conduct their research.

In turn, engineers often use knowledge developed by scientists to inform the design of the technologies they create.

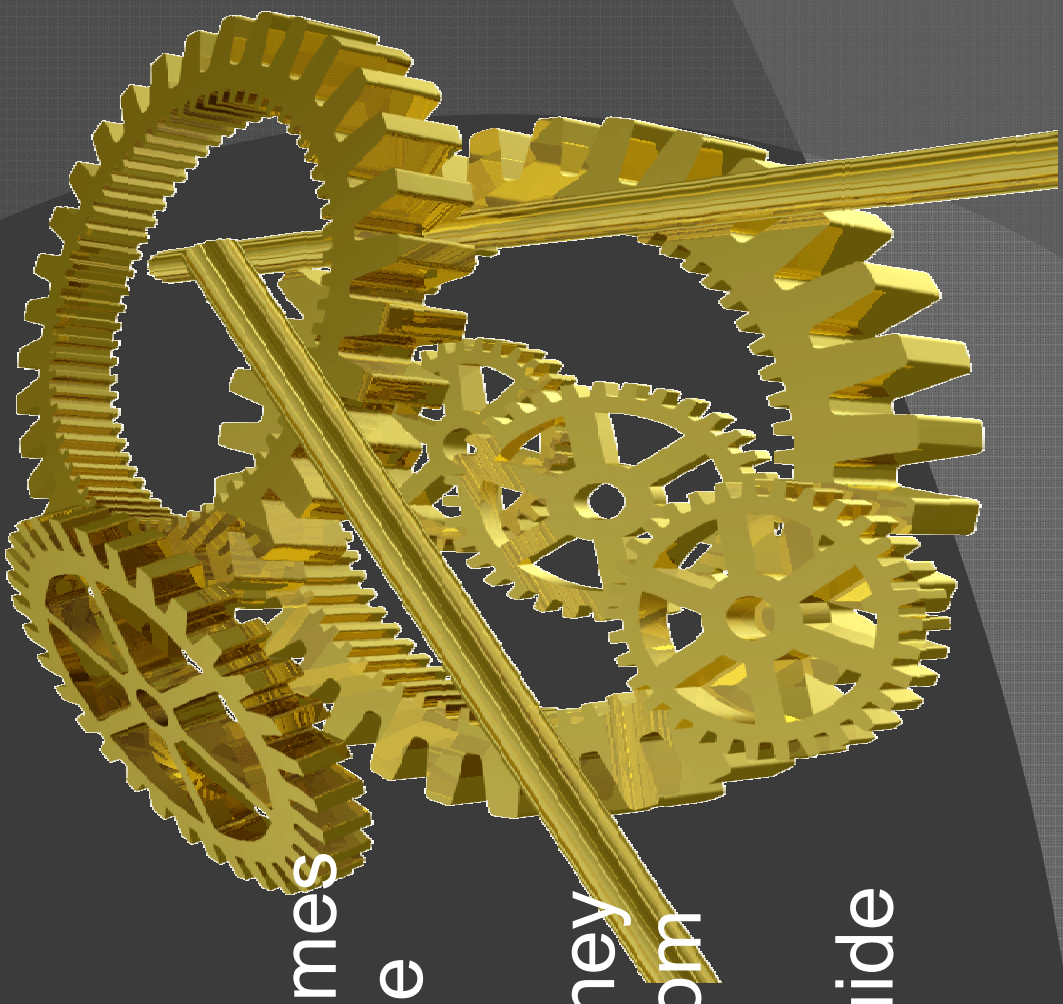
Why engineering in K-12?

- Children are often fascinated with building and with taking things apart to see how they work.
- Engineering projects integrate other disciplines.
- Fosters problem-solving skills and creativity.
- Embraces project-based learning and encompasses hands-on construction.
- Increases students' awareness of and access to scientific and technical careers.
- Engineering and technological literacy are necessary for the 21st century.



Teaching Engineering

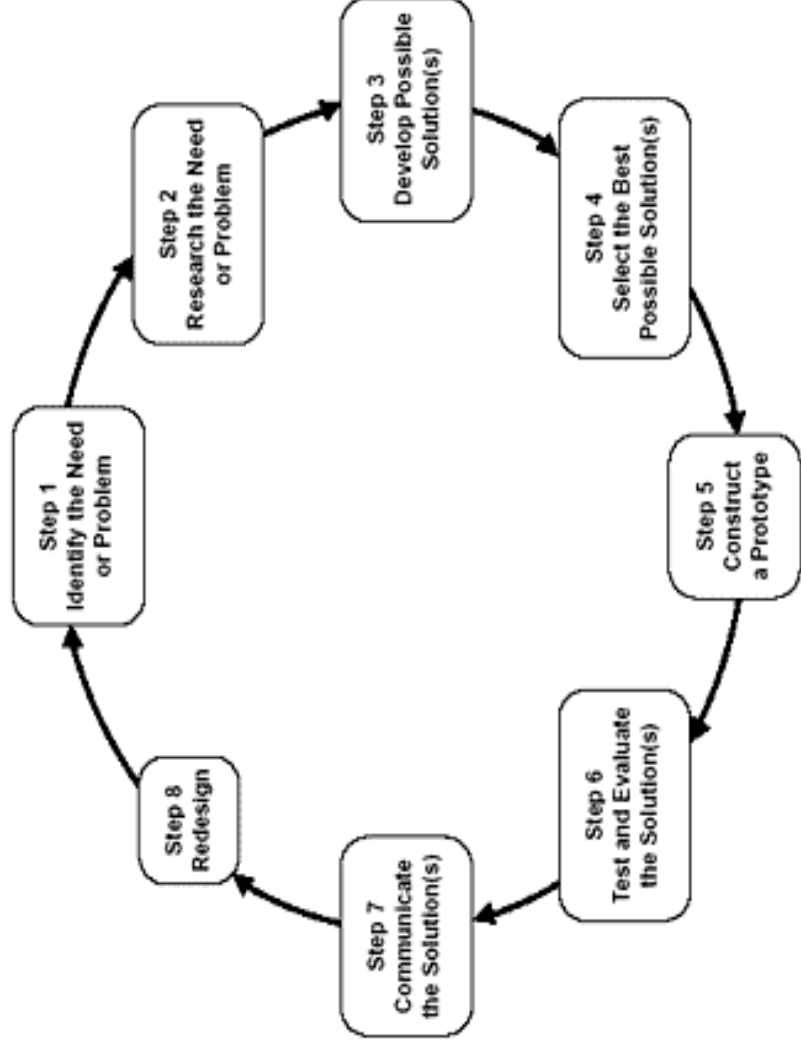
- Provide authentic, hands-on tasks
- Clearly define outcomes that allow for multiple solutions
- Assist students as they integrate learning from other disciplines
- Allow students to guide process



Engineering Design Process

1. Identification of Need
2. Research
3. Develop and Analyze Possible Solutions
4. Select Best Solution
5. Construct a Prototype
6. Test and Evaluate
7. Communicate
8. Redesign

Figure 1
Steps of the Engineering Design Process



Example: Elementary Level Engineering Lesson

Windmills: Putting Wind Energy to Work

- Students review the engineering design process and discuss how wind can be used to help get work done.
- They look at a variety of windmills, focusing on the different materials used in the construction of windmills and the type of work each windmill is designed to do.
- Finally, they use simple materials to build their own windmills to do work.

Example Secondary Level Engineering Lessons

Ship the Chip

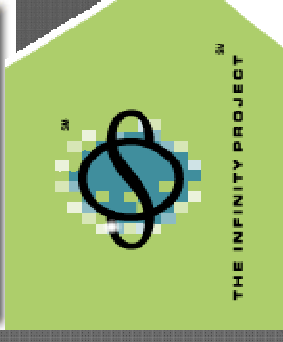
- Students work in teams of "engineers" to design a package using standard materials that will safely ship a single chip through the mail to the school address.

Irrigation Ideas

- The challenge is to move two cups of water for at least three feet and distribute it evenly in two separate containers. Students work with everyday items, develop a plan, build their "irrigation" system, and test their system.

K-12 Engineering Curriculum

- **Project Lead the Way** - series of middle and high school courses <http://www.pltw.org/index.html>
- **Engineering byDesign** - national curriculum model for Grades K-12 <http://www.iteaconnect.org/EbD/ebd.htm>
- **Engineering is Elementary** – 20 curricular units (storybooks) for elementary grades <http://www.mos.org/eie/index.php>
- **The Infinity Project** – year-long high school course that includes a technology kit www.infinity-project.org



Other Online Resources

- <http://www.teachengineering.org/> - free digital library of K-12 engineering lessons
- <http://www.engineeringk12.org/> - American Society of Engineering Education's site devoted to K-12
- <http://www.prek-12engineering.org/> - Massachusetts-based site; resources for teachers
- <http://www.engineeringpathway.com/ep/k12/index.jhtml> - searchable database of lessons

