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The Engineering Design Process

6th Grade Lesson Plan, may be adjusted for grade levels 4-8.
Revised by Laura Sanders, Environmental Science Institute
Original lesson written by **The Works Museum in Minnesota,** which offers teachers three lesson plans and two Powerpoint presentations that can be used before and after a class visit to the museum, each focusing on the engineering design process. Download further ideas from The Works, aligned to the Minnesota 2009 standards, suggesting ways to integrate engineering into an elementary school curriculum. Posted on June 7th, 2010 by ASEE on:
http://www.theworks.org/fb/teachers/state_standards.html

Sample TEKS: Beginning with School Year 2010-2011. §112.16. Science, Grade 5: 2A, 3A, 3C; §112.18. Science, Grade 6: 2A, 2B, 3A, 3B, 3C; §112.19. Science, Grade 7: 2A, 2B, 3A, 3B, 3C

Concepts: This lesson consists of two simple activities aimed at introducing students to the engineering design process and involving them in creative problem solving. The skills learned in engineering are useful in many facets of everyday life. Students first work through a chart detailing the steps of the design process, and then use the steps to consider ways to solve one of three problems: rescuing a trapped kitten, devising a way to water plants while on vacation, and rigging up a remote light switch. These two activities are designed in such a way that they complement each other, yet each can stand alone.

Activity 1: The Engineering Design Process

On the first page of the worksheet (http://teachers.egfi-k12.org/wp-content/uploads/2010/05/Post-lesson-Student-Activities-Engineers-and-the-Engineering-Design-Process.pdf), the students are presented with a chart of the engineering design process. The names of the steps are given in the proper order, but the boxes for the descriptions are left blank.

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.]

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Activity 2: Creative Problem Solving

On the second page of the worksheet (http://teachers.egfi-k12.org/wp-content/uploads/2010/05/Post-lesson-Student-Activities-Engineers-and-the-Engineering-Design-Process.pdf), students are asked to exercise their creative problem-solving skills.

The Worksheet challenge for students:

The engineering design process helps engineers and other problem-solvers come up with creative solutions. You are an engineer. Choose ONE engineering problem below, and follow the steps to invent a solution.

A. Your new pet kitten is trapped in a ten feet deep hole. You need a contraption to safely rescue your poor animal.

B. You are going on vacation for a month and can't find anyone to water your plants while you're gone. You need a device that will give your plants the right amount of water – not too much and not too little.

C. You like to read before you go to sleep, but you don't have a bedside lamp. You need a way to turn off the light switch across the room without having to get out of bed.

Evaluation and Extension:

1) What problem did you choose? Brainstorm ways to solve the problem and list several possible solutions.
2) Choose one idea. On the back of this page, draw a detailed picture of the solution you chose. Label the drawing to explain what each part is made out of, how the parts fit together, and how it will work.
3) Where do you think you will run into problems with your solution? Where do you think the weak parts in your creation will be?

Notes to the teacher: In doing this activity, students might need more guidance than they get from the instructions. A good way to offer support is to ask specific, thought-provoking questions that don't have a "right" answer in mind.

For example, suppose the student has chosen to solve problem B: "You are going on vacation and can't find anyone to water your plants while you're gone. You need a device that will give your plants the right amount of water – not too much and not too little."

During the "Identify the Problem" step, the teacher could ask:

- How much water does a plant need? How often does it need to be watered?
- What are some ways people move water from place to place? Could you use gravity, electricity or another force to help you?
- What are some containers you've seen water in?

During the "Design" step, the teacher could ask (referring to the student's drawing):

- How does it work?
- What material is this made out of? How big is this part?
- How does this connection work? How does this fit together?