Session 9

A Solution Taking Shape

Thinking Creatively

In This Session:

A) Invitation to Invent (45 minutes)
- Student Handout

B) Patents (60 Minutes)
- Student Handout
- Student Reading

C) How Stuff Works (45 Minutes)
- Student Handout

Home Improvement
- Student Handout

A Solution Taking Shape involves online research. In this session, plan out one of your design solutions by following Steps 5 and 6 of the design process.

The first activity of this session, *9A: Invitation to Invent*, exposes you to inventors and inventions throughout history, to see how others applied creative thinking to solve problems. In the second activity *9B: Patents*, use the U.S. government's official patent Web site to dig into the world of patents, looking for products that might be similar to their idea. This helps you refine your solution. In the third activity, visit the Web site, *HowStuffWorks*, which provides online tutorials about the inner workings of things.

The Home Improvement activity, *Project Analysis*, helps you refine your ideas before making a final decision about your solution.

Invitation to Invent

Handout: Session 9, Activity A

Have you ever thought about who invented bubble gum and how? In this activity, you will have some time to peruse others' inventions and learn about what inspired them. Let their inventions inspire the creative thinker in you!

Simple Inventions That Changed Lives

1. Go to the Rolex* Awards for Enterprise Web site, www.rolexawards.com/*.
2. Click on *Inventions* under *Special Features*.
3. Look at a couple of the examples of the simple but effective solutions to problems.
4. What makes these inventions successful?

More Inventions

1. Go to National Inventors Hall of Fame*, www.invent.org/index.asp*.
    a. In the upper left-hand corner, move your cursor to *Hall of Fame* (in light gray print).
    b. Underneath Hall of Fame, click on *Invention Channels*.
    c. Notice that you can choose from the following categories: computer; communications, agriculture, electricity, chemistry, imaging, medical, industrial, and Nobel Prize Winners.
    d. Click on *Chemistry*.
    e. Notice that within this category there are various inventions to choose from. Click on *Kevlar*.
    f. You find that Kevlar* was invented by Stephanie Louise Kwolek. Remember her?
    g. Repeat this procedure for other categories and inventions. Check out the *Imaging* category and click on *multiplane camera*: Who was the inventor?
2. Select one invention that interests you and read about how it was invented. On the National Inventors Hall of Fame, you will need to select the *Invention Channels*, and then choose a category. Consider the following:
    a. What is the invention?
    b. Was the invention accidental or intentional?

9A Handout: Invitation to Invent (continued)

c. What problem was the inventor trying to solve?

d. Was it an adaptation of something already invented or something completely new?

e. What kinds of things did the inventor need to know about or learn about when developing the invention?

f. What was the impact of the invention?

g. What other inventions can you think of that have been adapted from this invention? How are they improvements?

3. Now view a timeline of inventions, www.cbc.ca/kids/general/the-lab/history-of-invention/default.html* and look for trends in inventions.

   a. What kinds of things were invented first?

   b. Most recently?

   c. How does history effect inventions?

Patents

Handout: Session 9, Activity B

In this activity, you will become familiar with the U.S. Patent Web site (or the patent site for your country) and find inventions that are similar to your own ideas. Many times another solution can help you refine your own ideas.

Patent Search for a Problem or Idea

Go to the U.S. Patent and Trademark Web site, www.uspto.gov*.

1. We'll practice with the example of finding other solutions to the toothpaste problem. Click on *Patents*.

2. Click on *Search*, under *Patents* on the left side of the Web site.

3. Under *Issued Patent*, click on *Quick Search*.

4. Come up with key words to search. For example, in term 1, enter *toothpaste*, and in term 2 enter *cap*, and click on *Search*.

5. Your results: Notice the different patent titles that address toothpaste caps.

6. If you click on one of these, you'll find information about that patent design. Click on *images* at the bottom to see sketches of the idea. Explore each separate patent to find out about other inventors' approaches to problems and see that there are quite a variety of engineering solutions, materials, and design ideas to the same problem!

Patent Search for Your Design Solutions

1. Now that you are familiar with how to do a patent search, you can use the patent site for your own research on design solutions. This process will help you see if anyone else thought of an idea like yours, and if so, how those solutions are similar to or different from your ideas. It should also help you plan your solution. Here's how to do a search:

    a. Decide if you are going to conduct your search by the problem or solution.

    b. Come up with key words to search.

    c. Once you have some results, explore each separate patent to find out about other inventors' approaches to problems and see that there are quite a variety of engineering solutions, materials, and design ideas to the same problem!

    d. As you conduct the search, ask yourself the following questions:

        - How do other inventors view the nature of the problem?

9B Handout: Patents (continued)

- In looking at the various patents that are similar, are the inventors designing for the same "user"? How do the different solutions show that inventors may consider different aspects of a user's life, environment, and behaviors?
- What materials have other inventors used to address the problem?
- What do other inventors' sketches/designs look like? What are the similarities/differences in the design solutions?
- What components have other people used? Have they considered similar or very different components for their design solutions? Have they used the same essential components but arranged them in a different way?
- Do different parts of the various inventions captivate you? How can you recombine their ideas to improve on the solution to the original problem?

2. In your design notebook, describe any revisions on new ideas you have for your solution based on the patent site research.

Meet a Student Engineer

Reading: Session 9, Activity B

Ryan Patterson: "All Technology Should Be Assistive"
While he was still in high school, Ryan Patterson invented an electronic device to improve the lives of deaf and hearing-impaired people. His Sign Language Translator uses a golf glove equipped with wireless microprocessor circuitry to translate American Sign Language into letters that can be read on a small, portable handheld display screen, eliminating the need for a human interpreter.

Patterson says the idea came to him when he was watching a group of deaf people try to place an order at a fast-food restaurant. They needed an interpreter to translate American Sign Language so that the restaurant staff could understand them. Patterson saw an opportunity to harness technology to solve a communications challenge. "All technology should be assistive, if it's worth anything," he believes.

To make his idea work, Patterson embarked on a research and engineering project that required learning several computer programming languages and overcoming technical challenges that sometimes "felt like I was hitting a concrete wall."

It's all been worth the effort, he says. The invention earned Patterson top honors and generous college scholarships at prestigious science fairs, including the Intel International Science and Engineering Fair in 2001 and the Intel Science Talent Search in 2002. It also catapulted him into the media spotlight, including coverage in *People Magazine*, interviews with CNN, and a spot in the National Gallery for America's Young Inventors.

Currently an engineering student at the University of Colorado, Patterson continues using problem-solving strategies to solve new challenges and engineer new products. As an undergraduate, he has his own research laboratory outfitted with state-of-the-art equipment. "I feel like the luckiest person in the world," he says.

An Early Start
Patterson's interest in engineering goes way back. As a toddler, his favorite toys were extension cords and screwdrivers. By elementary school, he was asking questions about electricity that stumped his parents and teachers. A teacher recruited John McConnell, a retired particle physicist, to mentor the inquisitive young student. For the next seven years, the two spent nearly every Saturday working together in the mentor's workshop on projects that involved electronics and other technical fields.

For Patterson, those early experiences "helped me get a foundation in science." His mentor introduced him to technical concepts through hands-on activities, such as building robots and

9B Reading: Meet a Student Engineer (continued)

wiring electronic circuitry. McConnell was also modeling what it means to be a scientist, engaged in the process of asking questions and seeking answers.

By high school, Patterson was ready to work independently on his own research projects. His mentor was still there as a sounding board and supporter. For example, Patterson faced a host of technical challenges in making his glove device work. His mentor "taught me what a scientist does when he gets stuck: He researches, reads books, and consults experts. John taught me I could email experts, like the people who make chips or circuit boards, and ask them my technical questions. I went through the same cycle that a professional engineer would do."

One quality came instinctively, says the mentor. "Ryan has the tenacity to dig and dig and dig." McConnell says he could see that drive in the student the first time they met. "You could see he had that focus, that intensity. I said to myself, 'Wow! This kid is extraordinary.' I realized I had to do something to encourage him."

Value of Patience

As he has pursued college studies in engineering, Patterson has also come to appreciate the importance of patience. "It can take years of development before an idea is available for people to use," he says.

For now, work on his Sign Language Translator is on hold while Patterson tackles other problems. A current research project involves using a handheld device to assist persons with cognitive disabilities, such as brain damage, function more easily in daily life. "This could lead to an assistive technology that helps a person understand where he is, instead of having to rely on a caregiver," he explains.

What keeps Patterson motivated, whether he's studying for a tough engineering class or working on his next invention? "You do it for the love of it," he says simply. "Once you get a past a challenge, your confidence grows. It's just like being a mountain climber. Why do they keep at it? It's the same kind of thing for me."

How Stuff Works

Handout: Session 9, Activity C

In this activity, you will begin to plan the development process of your design. The Web site, *HowStuffWorks**, can help you learn about how things are made.

Sample Search on *HowStuffWorks*

1. Go to http://www.howstuffworks.com*.
2. Go directly to the left side of the page where it says Explore Stuff.
3. Let's say you want to build a mechanical toy, and that the toy will need wheels and gears, but at this point you know little about them.
4. Type *gear* into the *Search* field.
5. Notice that *HowStuffWorks* gives you results from the Web and from *HowStuffWorks*. For this activity, we will use results from *HowStuffWorks*.
6. At the bottom of the page, click on *Next*... and keep clicking on *Next*. You have a lot of results!
7. Perhaps you should narrow your search. But before you do, look through some of the results; the perfect link may be right on the first page, as the best matches to your search term are listed first. Even on the first page, you have quite a choice: *How Bicycles Work; How Gears Work; How Gear Ratios Work...*
8. Click on *How Gears Work*.
9. Notice the terms *gear reduction*, *power*, and *torque* link to more information. The amazing thing about the *HowStuffWorks* Web site is that you can delve as deeply as you wish into a subject area. Before you click on the next link, however, go to the end of this article and notice the *Table of Contents* area. You can click on a link related to *How Gears Work* and investigate the *Basics; Spur Gears, Helical Gears, Bevel Gears...*
10. Go back and click on *torque*.
11. What do you find here? Everything you may have wanted to know about torque, complete with illustrations. But if not, go to the end of the article and see the links.

Your Own Search on *HowStuffWorks*

1. Before conducting a search, ask yourself the following questions:
    - What is my design similar to?
    - What are the different systems or components of my design?

9C Handout: How Stuff Works (continued)

2. To conduct a search that will help you with your own design, do the following:

    - If it is an adaptation to an existing product, search for the product. Learn about how the product is made: the systems, components, and materials.
    - Search for a similar product and see how that is made.
    - If you are planning to make a change to a particular part of a product, search for the part (such as gears in the example) to learn more about that part.

3. Search the site to learn more about how you might go about developing your design.

4. Remember to take good notes in your design notebooks. Record keeping is very important in this process!

Project Analysis

Handout: Session 9, Home Improvement

Now that you have narrowed your design solution, you are ready for the second part of Step 5 of the design process: Refine Your Solution. Analyze the solution for cost, safety, and practicality. Give your design project more thought and answer the following questions about your design solution. You will need to do testing throughout your project development to ensure that your project is safe, durable, and works the way you want it to. Respond to the following questions in your design notebook.

1. Is my idea practical? If so, how?
2. Can it be made easily? How?
3. Is it as simple as possible? Explain.
4. Is it safe? How?
5. Is my product durable? Will it withstand use, or will it break easily? Explain.
6. Will it cost too much to make or use? Explain.
7. Is my idea really new? Explain.
8. Is my idea similar to something else? Explain.
9. Will people really use my product? How?

Now, survey your friends and family using these same questions and see what they think about your idea.