

SECTION 3

BECOME AN ENGINEER!

Length of Lesson: 120 min

Desired Results

1. Technological Literacy Standard 13: Students will develop abilities to use and maintain technological products and systems:

Use information provided in manuals, protocols, or by experienced people to see and understand how things work

2. Science:

As a result of the activities in grades 5-8, all students should develop and understanding of:

- Populations, resources, and environments
- Natural hazards
- Risks and benefits

Prerequisites:

- Read at sixth grade level or above
- Possess basic computer skills in word processing and searching the web

Tools, Materials, and Equipment Required:

- Computers that have access to internet
- LCD projector to present Power Point
- Area for students to have discussions

Supporting Resources

- <http://www.epa.gov/recyclecity/>

This is a website designed for students. It provides a “recycle city” for students and teaches them why we need recycle and how to recycle.

Active Learning Plan

Preparation of teacher before lesson is taught (30 min)

- Review the ideas and objectives of the lesson.
- Visit and review following sites:

http://en.wikipedia.org/wiki/Paper_recycling

It introduces the concept of paper recycling and offers some background information about paper recycling.

<http://earth911.com/recycling/paper/learn-how-to-make-recycled-paper/>

<http://www.make-stuff.com/recycling/paper.html>

<http://montessoribychand.blogspot.com/2008/04/how-to-make-recycled-paper.html>

These are websites offer methods for making recycled paper at home.

Presentation (50 min)

- Scenario:
Your school has collected waste paper for several years. Recently, the recycling center raised the recycling fee, so the principle intends to recycle paper at the school. As a participant, you are being asked to design a recycling process and illustrate your use of the recycled paper. You will work in groups and play the roles of engineers to solve the engineering design problem.
- Introduce the benefits of recycling (See Hand out).
- Illustrate the problem: design a system using waste paper make recycled paper.
- Discuss: to solve this problem, what engineers do in each step according to Eide's model?

- Discuss what kind of information students should search for.
- Explain how to record information in their design journal.

Application (70 min)

- Require each work group to search for and record related information on website:
<http://earth911.com/recycling/paper/learn-how-to-make-recycled-paper/>
<http://www.make-stuff.com/recycling/paper.html>
<http://montessoribyhand.blogspot.com/2008/04/how-to-make-recycled-paper.html>
- Rubric
See Table 2 to check the rubric for the lesson

Reflection

- What happened during the lesson? How effective was the lesson plan?
- How the desired results were met? What are the next steps to improve student learning?

References

United States Environmental Protection Agency. (2010). Recycled City. Retrieved May 29, 2010 from: <http://www.epa.gov/recyclecity/>

Earth911.com(2010). Learn how to make recycled paper. Retrieved May 29, 2010 from: <http://earth911.com/recycling/paper/learn-how-to-make-recycled-paper/>

Hamilton County Recycling and Solid Waste District. (2010). Recycling Benefits. Retrieved May 29, 2010 from: <http://www.hamiltoncountyrecycles.org/index.php?page=recycling-benefits>

Environmental Benefits of Recycling

Environmental Benefits of Recycling

1. Conserves Energy

Using recycled materials as raw materials to make new products saves a significant amount of energy. Here's how much these materials save compared to their virgin counterparts.

- Recycled newspaper uses 40% less energy.
- Recycled glass uses 40% less energy.
- Recycled steel uses 60% less energy.
- Recycled plastic uses 70% less energy.
- Recycled aluminum uses 95% less energy.

2. Saves Natural Resources

Using recycled materials means we can log fewer forests, mine fewer metals, and drill for less oil.

- Every ton of newspaper or mixed paper recycled saves the equivalent of 12 trees.
- Every ton of office paper recycled saves the equivalent of 24 trees.
- Every ton of steel recycled conserves 2,500 pounds of iron ore, 1,400

pounds of coal, and 120 pounds of limestone.

3. Greenhouse Gas Emissions

The national recycling rate of 30% reduces greenhouse gas emissions by as much as removing nearly 25 million cars from the road.

References

United States Environmental Protection Agency. (2010). Recycled City. Retrieved May 29, 2010 from: <http://www.epa.gov/recyclecity/>

Earth911.com(2010). Learn how to make recycled paper. Retrieved May 29, 2010 from: <http://earth911.com/recycling/paper/learn-how-to-make-recycled-paper/>

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How to Make Your Own Recycled Paper

Trees are made up of cellulose fibers that are held together with a glue-like substance called lignin. This makes trees strong enough to use for building houses and furniture. When wood is cooked, the cellulose is separated from the lignin to make wood pulp. This pulp is made into paper.

However, people did not always write on paper from wood. In ancient times, people wrote on animal skins, bones and clay tablets. Around 3500 BC, the Egyptians wrote on a woven mat of reeds called papyrus, which is where the word paper comes from. Around 2,000 years ago, the Chinese discovered that they could make a thin paste of mulberry bark, hemp and rags and let it dry into a sheet in the sun. Many types of paper are now made from wood.

The modern day method of making paper is as follows: Logs are chipped into small pieces of wood. These chips are cooked with chemicals that dissolve the glue-like lignin holding the wood fibers together. This process leaves a pulp made of cellulose fibers and lots of water. Then, the pulp is put on a screen to let the water drain away. The fibers remain to form a sheet of paper that is dried and put on a roll. When we recycle paper we use the wood pulp/cellulose over and over again.

NOTE: Making recycled paper can be a bit messy, but fun. Have appropriate supervision because the process involves using an electric blender and a utility blade and/or scissors.

This method is adapted from: www.Earth911.com

Materials Needed To Make Recycled Paper

- A newspaper
- A blender
- Water
- A kitchen sink with a good drain plug or a large plastic tub/container
- Two one-square foot of fiberglass screen
- Scissors

Optional Materials

- A sponge and blotting paper
- Rolling pin
- Colored construction paper
- Colored threads
- Glitter
- Small leaves

- Colored thread

Step 1—Tear the Newspaper

Gather 3 sheets of newspaper and record the number of sheets that you used in your design journal. Calculate total area of the paper you used and record the number. Tear a section of newspaper into roughly one inch pieces. You can use scissors if you want. Be safe!

Step 2—Make the Slurry

Slurry is the paper pulp and water mixture. It might remind you of dirty old oatmeal.

To make the slurry you will need to get an adult to help you.

Place one cup of the torn newspaper into the blender with two cups of water. Record the total number of cups of water required to turn all of your paper into slurry. Put the lid on the blender and turn it on high. Let the blender run until all of the paper disappears and it appears as if you have a purple-grey, pulpy mixture (again, it may remind you of dirty old oatmeal).

Step 3—Add the Slurry to the Container

Place about four inches of water into the kitchen sink (with the drain plugged) or large plastic tub/container. Add the slurry mixture to the water in the sink or container.

You may notice that the suspended paper fibers in the water that make up the slurry feel soft. If you look really closely at other paper fibers in paper products such as tissue or toilet paper (pull the paper apart a little), you may notice that the fibers look similar!

Step 4—Making the Paper

Mix up the slurry and water mixture in the sink or container really well. You can use your hands! NOTE: You will need to remix the slurry each time you make a new piece of paper.

Hold your screen with both hands on the edges and scoop it down towards the bottom of the sink or container at a slight angle. Slowly lift it out of the water allowing the water to drain out (back into the sink or container) for about a minute. You should have a thin layer of paper fibers settling on the surface of the fiberglass screen framed by the edges you cut out of the pans.

NOTE: You do not want to have it too thick (more than 1/4 inch) or too thin (you can see the screen in patches) on the screen of your deckle or the paper will be difficult to work with. You can run your finger along the bottom of the screen to help get the water off.

Step 5—Fixing the Paper

Set your second screen on the top of the screen with wet paper. Be careful, do not break the surface of the paper.

Using the rolling pin to squeeze the extra water in the paper.

NOTE: You do not want to dry the paper too much while it is still between the screen.

Step 6—Drying the Paper

Leave the paper between the screens for several hours.

Step 7—Peeling the Paper

Gently peel the paper off the screens, there is your paper! Measure the area of the paper that you made and record the number in your design journal.

Step 8—Cut the Paper

Use scissors to cut the paper into the shape you want. Be careful!

You can experiment further by adding a cupful of colored construction paper blended in the same manner of the newspaper to your slurry to make colored paper. You can also add colored threads, glitter, small leaves, etc. to the slurry to make your paper more interesting.

References

United States Environmental Protection Agency. (2010). Recycled City. Retrieved May 29, 2010 from: <http://www.epa.gov/recyclecity/>

Earth911.com(2010). Learn how to make recycled paper. Retrieved May 29, 2010 from: <http://earth911.com/recycling/paper/learn-how-to-make-recycled-paper/>

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