Lesson 2: Design a Better Bag

Summary

Grade Level: 6–12

Students explore the creative process and understand the invention/innovation process through examining how paper bags are constructed. Teams of students work cooperatively to design, innovate, and then build their own paper bag models designed to hold as much weight as possible in proportion to its volume.

State of Wisconsin Academic Standards

Fine Arts, Language Arts, Science, Social Studies

Objectives

- Work in cooperative groups to develop a solution/innovation
- Understand the invention/innovation process
- Redesign and improve on an everyday object
- Reflect on the industrial design of an everyday object through critical thinking questions and creative thinking
- Reflect on the innovation process through expository writing

Materials Needed

- Examples of paper containers and bags (examples: lunch bag, v-shaped bag, grocery bag)
- Pencils and drawing paper
- Oranges/grapefruits, weights, or blocks of modeling clay
- 11 x 17 in. paper or larger craft paper
- Cardboard, string, plastic, Velcro, stapler and staples, or other materials that could be used for handles, dividers, and general construction and design of the paper bag
- Scissors, glue, rulers
- Markers, colored pencils, paint, etc. for decorating the surface of the bag

What to Do

Discuss with your students how natural containers include nests, eggs, seashells, and kangaroos' pouches. People have made containers from many different materials including clay, fabric, wood, glass, cardboard, and steel. Containers are used to hold, store, protect, and carry all sorts of things. Sacks, nets, cans, buckets, cartons, and bowls are just a few examples of containers that have to cope with forces from inside. Thousands of paper bags are used every day to hold and carry lots of different things too.

Margaret "Mattie" Knight did not invent the paper bag, but she was the person behind giving it a flat bottom. While working in a paper bag factory in 1867—at a third of the wage of a man—Knight studied the machinery and imagined improvements. In her room in a boarding house, she designed and built a wooden model of an automatic bag-making machine, which she tested thousands of times before hiring a machinist to build an iron model. At the time, paper bags had v-shaped bottoms and they were pasted together by hand. Knight's machine cut, folded, and glued the bags with flat bottoms. The machine caught eye of at least one visitor to the factory, who tried to steal Knight's design, confident that no court at that time would believe that a woman could have designed it. But Knight won her day in court when she produced a diary with 1,867 entries documenting the many hours she had worked on her invention.

Before applying for a patent, Knight rejected many designs for the bag-making machine, discarded many models, and sought expertise from many people. What kept her going? Each model improved the last model because of her discoveries, mistakes, and thinking process. As inventors and designers grow closer to their problem-solving goal, they often become obsessed with "getting it right." Perseverance and fulfilling a need are just two lessons to learn from Margaret Knight.

- Divide the students into teams and give each team several types of paper bags, scissors, and weights.
- Ask the students to study the various paper bags, gently take them apart, load them with weighted objects, and list their observations to the following:
  - Why are grocery bags pleated?
  - Why are bags made of different types of paper?

- Why do grocery bags have rectangular bottoms and other bags don't?
- Why don't all bags have handles?
- Is the paper uniform in thickness?
- What makes the bag strong? Look at sizes, shapes, cuts, and folds.
- What special features does the bag have? What do these features do?
- How many pieces of paper does it take to make a bag?
- What is the weakest part of a paper bag?
- Which parts of a paper bag get the most abuse?

• Have the students brainstorm ideas on how they could improve the design of a paper bag and sketch their redesigned paper bag ideas on drawing paper.
• Encourage the students to consider how handles make bags easier to carry and include handles in their redesign of the paper bag. Have them look at handles on knapsacks, sports bags, carryalls, and others items for ideas. Ask them to consider the following questions:
- What could you use to make bag handles that are strong and comfortable?
- How will you attach them to the bag?
- Does the bag need to be stronger where handles are attached?
- How could you accomplish this?
- Can you make other parts of the bag stronger?

• Inform the students that their redesigned paper bag must be able to hold at least three grapefruits, five oranges, or similar weight and volume.
• Distribute the craft paper and other art supplies to the students and have them make a model of their redesigned paper bags. Remind students that it is okay to change their design midstream. As they begin to construct the bag, they may have additional thoughts and ideas. Challenge the students to build a bag that uses as few materials as possible—and thus would be cheaper to manufacture—but can still hold a certain amount of weight and volume.
• After the paper bags are completed, have each team present their redesign to the class and test their paper bag using the designated weight and volume. Presenters explain the paper bag design changes they made and why, while listeners can give feedback on the changes and suggest other ideas they may have to improve the product.
• Have teams reflect on their designs through expository writing, including the original problem and solution, sequence/steps of making the redesigned bag, and schematic drawings of the finished object.

Teacher Options

• Have students keep a diary/journal with entries documenting their observations, ideas, experiments, etc. while working on the product redesign.
• Have students develop an advertising poster for their redesigned product.
Visit a local manufacturing company to see how products are developed and mass-produced.