

Ms. Virginia's Cookie Factory

Target Level:

K-6

SOLs:

Science 4.8 and 6.11

Materials Needed:

(based on a class of 30)

- 6 rolling pins
- 6 sets of 2 or 3 cookie cutters
or 6 play-doh fun factories
- 6 plastic bags or pieces of wax paper, or easel paper (or other surface to roll play-doh)
- 6 cans of red, white and blue play-doh (3 colors)

Optional:

- 6 plastic containers labeled "flammable" or "hazardous" and "handle with caution" lids
- Newspaper for floor
- Role cards (see copy page)
- Ruler, markers and paper for each team
- Play money
- Kitchen scale
- Copy of "Recycling Rules"

Time Needed:

One class period

Summary:

In this activity, students plan how to use resources to "manufacture" cookies and discover ways to manage their raw materials and reduce wastes.

Objectives:

1. Students understand that manufacturing processes use natural resources to produce a product.
2. Students understand that manufacturing products also produces wastes, and in many cases, wastes can be reduced to help prevent pollution.
3. Students learn that wastes produced by industry are handled differently and are not just "thrown away" – they can be recycled, reprocessed, or disposed of using environmentally – approved methods to prevent pollution.

Background:

Industries use natural resources to manufacture goods. Different kinds of wastes are (pollution) generated as a by-product of manufacturing. All industries attempt to reduce waste in order to increase profits and to reduce the amount of waste produced. Any waste produced costs money – both in lost resources and in cost for disposal. Preventing waste prevents pollution and makes good economic sense for business.

Roles:

Customer: The leader (teacher) becomes the customer after play-doh machines (or cookies cutters and rolling pins) are handed out and instructions are explained. An alternative could be to invite a parent or other adult in to be the customer. The customer's role is to place orders, create pressure, demand quality and generally harass the teams with the goal of creating an atmosphere of good-natured competition chaos. The customer circulates to each team and places his order with the "big boss." Orders can be for cookies, CDs, computer parts, or any "product" the students will relate to. After the teams have begun working, the customer begins requesting samples from each team and inspects their quality. While inspecting each team's product, the customer mentions how well their competition is performing. The customer inspects each team's product, mentions the competition's performance and how important the job is to their company.

Procedure:

1. Divide the class into groups of 5 or 6. Give each group the play-doh, materials and role cards.
2. Have each group choose a name for their business (we suggest "cookies" as the product since it's harder for students to label this industry as "bad" – other manufactured goods such as computer parts or CDs would also work). The students can design a logo and make a company sign for their work table.
3. Explain that the teams are in competition with each other to produce confections (or computer parts, etc.) desired by a customer. They must be made to exacting standards or the customer will not buy them.

4. Red play-doh is a raw material that can not be reused (dough you can roll only once) or must be disposed of carefully (e.g. flammable or hazardous). Blue and white play-doh can be recycled under certain conditions (e.g. fed to animals). If the play-doh is mixed then the raw materials are contaminated and customer will not buy the product. Play-doh must be recycled according to “approved methods” listed in the recycling rules.
5. Any red play-doh cannot be recycled and you must pay to have it removed. Pure blue and white play-doh can be recycled and should be sorted and stored correctly; it is worth money to your company. Any blue or white play-doh that has been extruded or rolled out or otherwise worked with cannot be reused in the manufacturing process and must be recycled immediately.
[Option: Blue or white could be specified as reusable in the manufacturing process to demonstrate the difference in waste generation.]
6. Give each group a few minutes to set up their equipment and supplies. Let them decide how to do this.
7. Give the teams the first order to make 10 blue stars (or other shape) with a length of 35 mm. The stars should be smooth on both sides and contain no mixed colors. The parts must be machine extruded, no hand molded stars allowed (unless you specify such).
8. When the first team is near completion, give the order to make 10 white stars with the same specifications.
9. When all teams have started on this order, have the customer decide that he/she needs an order of 3 red ropes 100 cm long before he/she needs the white stars. (Note: this change is designed to cause confusion and dismay among the teams as they must stop one task, change the play-doh, clean their equipment, and start another order.)
10. Once the teams have finished the red ropes, they can finish the white stars.
11. The customer will then inspect and “buy” all pieces that meet specifications once a team has finished all three orders. If some pieces do not meet the specifications, the team may work until the last team completes their third order. Once the last team has completed all the orders, all work must stop and all stations must be cleaned up. The teacher or other adult may now play the part of the recycling company and “buy” the uncontaminated, non-toxic materials at a specified price per gram (\$0.50/gram). Contaminated play-doh (mixed or red) must be hauled off by a waste management company. The factory pays to have it removed. (\$10.00/gram).

Wrap Up:

Ask the students what teams produced the least wasted play-doh and analyze why this might be the case. Ask students to predict ways they could organize the materials or change the process to get better results. How would employee training, new equipment, and/or new play-doh help?

Extension:

Have the teams calculate their “bottom lines” and discuss how they can increase their profits and decrease the waste generated. Ask the “inspectors” for their recommendations. Which team generated the most and least waste? Discuss how communications can be improved and how roles and processes should change to facilitate pollution prevention. Have the groups replay the activity with a “waste manager” on staff whose role is to remind other team members about contamination problems, correct storage and recycling methods. Other waste minimization ideas such as carefully estimating the amount of raw materials needed, can be employed.

Play-Doh Waste Management & Recycling Rules

1. _____-colored play-doh is not recyclable; you must pay to have it removed.
Cost of removal: \$10/gram
2. _____ and _____-colored play-doh are recyclable and should be sorted and stored in plastic baggies. Any play-doh that has been rolled, extruded or otherwise worked with, can **not** be reused in the manufacturing process and must be recycled immediately. Recycling rebate: \$0.50/gram).
3. The teams generating the **least** amount of waste (by weight) earns a bonus of \$200.00.

Reminder: If the final product (cookies) are multi-colored (the raw material of play-doh is mixed together) then they are contaminated and the parts will not be bought by the customer. These are high quality cookies you are making!

Manufacturing Specifications & Price List

1. Extruded Triangles:
35 mm, consistent length, smooth ends
2. Extruded Ropes
100 cm long, consistent width and length, smooth ends

Customer Order Form

	Quantity	Color
1. Extruded Triangles: 35 mm long @ \$10.00 each	_____	_____
	_____	_____
	_____	_____
2. Extruded Ropes: 10 cm long @ \$100.00 each	_____	_____
	_____	_____
	_____	_____

Balance Sheet

Profit or Loss Statement for _____
(company name)

Beginning Balance: + \$ _____
(money you started with)

Costs (supplies you bought):

Start-up kit (2 cans of play-doh & cleaning tools) (\$300): - \$ _____

Each extra can of play-doh (\$100): - \$ _____

Extra cleaning tools (\$10): - \$ _____

Subtotal: \$ _____

Gross Sales: + \$ _____
(amount of money you made)

Recycling Rebate + \$ _____
(\$0.50/gram received for used play-doh)

Inventory + \$ _____
(play-doh left over - not used - \$1.00/gram)

Ending Balance: \$ _____
(net worth)

Groups are broken down into the following:

1. **Big Boss:** In charge of the whole team's operation. Receives information from customer and passes information to other team members through Quality Control and Production Managers only, does not talk directly with any other team member. You keep your back to the team most of the time and think everything is late. You only care about the finished product and usually forget about the paperwork.
2. **Production Manager:** You are responsible for all deadlines. You need to make sure that the team members are always working and the product is getting made. You check out progress every 2 to 3 minutes only and think that most of the technicians aren't working fast enough.
3. **Quality Control:** You're the only guardian of the company's good name. It is your responsibility to make sure the product is the best it can be. If the product is not good enough for you, then it is not good enough. You're afraid that the technicians are trying to slip inferior products pass you.
4. **Technician** (1 or 2 per team): You are the workers. You do what the production manager says and make sure that the product meets the approval of the quality control person. Only you understand how the equipment works. You think you are underpaid and overworked and don't like to be pushed around.

The technician's assistant is only used when the class can not be divided evenly into groups of 5. Not all groups will have a technician's assistant.

5. **Technician's Assistant:** You assist the technicians however they ask. You usually end up with all the dirty jobs.
6. **DEQ Inspector:** (Optional) You know that every facility has something to hide and your job is to find it. The paper work is never filled out right; their records are never where they're supposed to be, and all the labels are upside down. You observe the process and recommend how to generate less waste.