



Cookie Mining Activity

Instructions

Note: Here are the teacher instructions for the Cookie Mining activity from the American Coal Foundation. In italics, I've commented on some of the instructions that I found unnecessary. I have not changed or deleted any of the text from the original American Coal Foundation instructions.

As indicated in my article, "Coal, Chocolate Chip Cookies, and Mountaintop Removal," I have played this game with high school students. I've also played it in teacher education classes and professional development workshops, examining the politics of curriculum. —Bill Bigelow

Overview

Students participate in a simulation of the mining process using chocolate chip cookies and toothpicks. The simulation helps to illustrate the costs associated with the mining of coal. Grade level: 3-8.

Objectives

Students will

1. participate in a simulated "mining" of chocolate chips from cookies, using play money to purchase the necessary property, tools, and labor; *[I didn't use play money, which needlessly complicates the game. Students can simply keep track of their profits on their worksheets.]*
2. understand the various costs associated with mining coal, including environmental remediation, as demonstrated in the simulation; and
3. calculate costs and profits from cookie mining and relate them to the mining industry.

National Standards

National Council for the Social Studies (NCSS) Standards

1. Production, Distribution, and Consumption
2. Science, Technology, and Society

National Council of Teachers of Mathematics (NCTM) Standards

3. Numbers and Operations, 3-5

Time Needed

One to two class periods *[Obviously, the duration of the game depends on the length of class periods. One could likely "play" it in a 50-minute period, but this would not offer sufficient time to debrief—nor would it offer time to do the pregame writing about coal, described in "Coal, Chocolate Chip Cookies, and Mountaintop Removal" if you've been able to locate some coal.]*

Materials

1. Play money *[Again, no need for this.]*
2. Three different types of commercially packaged chocolate chip cookies *[This sounds easier than it is. I tried to find cookies that were clearly different sizes and with different amount of chips. As I mention in my article, I had to distribute standard sized chips at the end because the chips in chocolate chip cookies vary greatly in size.]*
3. Grid paper
4. Pencils
5. Flat toothpicks
6. Round toothpicks
7. Paper clips
8. Cookie Mining Worksheet *[See Cookie Mining pdf.]*

Discussion Questions

What do you think are some of the costs associated with mining coal?

Do you know what the term *land reclamation* means?

If not, what do you think it might mean with regard to coal mining?

Procedure

1. Review the costs associated with coal mining: land acquisition, labor, equipment, and reclamation. Coal companies are required by federal law to return the land they mine to its original—or an improved—condition. This process, known as reclamation, is a significant expense for the industry.
2. Explain that the mining industry, like any other business, faces challenges to make itself profitable. To understand some of these challenges, students will attempt to conduct a profitable mining business in an experiment that requires them to mine the “coal” chips from chocolate chip cookies.
3. Give each student \$19 in play money [*Students can simply record this on their Cookie Mining Worksheet.*], a sheet of grid paper, and a Cookie Mining Worksheet. Allow each student to purchase one “mining property” (a cookie) from three separate brands available. Montana costs \$3, Pennsylvania costs \$5, and Kentucky costs \$7. Students may want to examine the cookies before deciding which one to purchase. [*I showed the cookies to students, but didn't allow them to “examine them,” as this can be time-consuming and is not essential for the game.*]
4. Once all the students have purchased their property, have them measure it by placing it on the grid paper and tracing it. Then have them count the number of squares that fall inside the circle (partial squares count as full squares). Tell students to record this number on the Cookie Mining Worksheet under D. Reclamation.
5. Have each student purchase “mining equipment” (flat and round toothpicks and paper clips). More than one piece of equipment may be purchased, but no tools may be shared among students. Sell a flat toothpick for \$2, a round toothpick for \$4, and a paper clip for \$6. Sell replacement tools when necessary.
6. Explain that each minute of mining (labor) costs \$1 and that each chocolate chip mined from their property will result in a \$2 profit. Broken chips may be combined to form a whole chip. Consumed chips will eat into profits!
7. Do not allow students to spend more than five minutes mining. If they spend less time, their labor cost will be lower. Have them record their mining time and labor cost under C. *Mining/excavation costs* on the Cookie Mining Worksheet.
8. After everyone is finished mining, have students restore their property to its original condition, within the drawn circle on the grid paper. This “reclamation” should also be timed, (no more than three minutes) and students may only use their tools, not fingers. After time is up, collect additional reclamation costs (\$1) for each square covered outside the original outline. Disburse profits for chips mined. Have students use the Cookie Mining Worksheet to calculate their profit or loss.

Assessment

Allow students to share their experiences with the class. Was making a profit easier or harder than they expected?

How accurate is this simulation in illustrating the challenges of making money in the mining industry? What costs or possibilities for profits were not included in this exercise?

Extension

Encourage students to design another profit/loss simulation for a different industry. Remind them to think of all the costs related to the industry and to try to create an exercise that can be done in a short period of time by the rest of the class. Have them prepare a worksheet for other students to complete after participating in the simulation, on which to calculate their profit or loss.

Differentiation

Working in tandem to complete the profit/loss worksheet might be helpful for those with math-related learning disabilities.



Coal Quotes

“Mountaintop removal mining may more appropriately be called mountain and stream annihilation. The tops of mountains hundreds of feet deep are blown apart to get at coal seams. Coal companies then dump the waste rock and debris in adjacent stream valleys, smothering the stream and any associated life. Mountaintop removal converts a biologically rich mountain ecosystem to a biological moonscape.”

—Janet Keating, co-director, **Ohio Valley Environmental Coalition West Virginia**

“You stand at the edge of one of these mountaintop removal sites and you’ll never feel the same way again,” says Mat Louis-Rosenberg, a staffer at Coal River Mountain Watch in southern West Virginia. The practice turns rolling mountains and valleys into flat, desolate moonscapes. Locals regularly hear the blasts of surface mines from their homes and then drink the resulting contaminants in their well water. When newly created lakes of toxic coal waste give way—as happened last December (2008), as a billion gallons of sludge flooded 300 acres of land near Harriman, Tennessee—they are the ones whose homes stand immediately downstream.

—Mark Engler, **Commondreams.org**

Dai Longcao said she had not been able to eat since the Sanhuiyi Coal Mine was ripped apart by a massive blast on Tuesday. “I held my children’s hands and walked three hours along the mountain path to the coal mine,” said the 42-year-old woman. “I took off immediately after I heard the news, and didn’t even get a minute to let my parents know what happened.” As her husband’s meager salary provides for the whole family, the housewife said she feared for the future of her son and daughter. Her fears were shared by a pair of sisters, whose spouses were also their families’ only breadwinners. Xia Xingrong and Xia Xingbi have their fingers crossed for their missing husbands. “If anything happened we’d be helpless,” they said.

—**South China Morning Post, March 21, 2005**

I called my daughter and wife. I don’t remember which one answered the phone. I believe it was my wife answered, yeah. And told her that the mine had blew up and her brother was still in there and told her to come on up to the mine.

—**from testimony, West Virginia Office of Miners’ Health and Safety**

More than 150 Chinese coal miners were dead or missing yesterday following three separate accidents in seven days, prompting renewed calls for better safety in the nation’s notoriously dangerous industry. . . . The spate of accidents prompted some state-run papers to repeat calls for better safety and reforms. “It seems unlikely that hearts of gold could be installed in mine owners and managers,” said *China Daily* in an editorial yesterday. More than 6,000 miners died in workplace accidents last year, according to government statistics. Labor rights groups say the figure could be as high as 20,000.

—**China Daily, April 11, 2006**

This is why the coal boom is so alarming. Right now about one quarter of the world's CO₂ emissions come from coal. If we go ahead with these new coal plants, they will add roughly 570 billion tons of CO₂ to the atmosphere over the life of the plants. (To put that number in perspective, 570 billion tons is about as much CO₂ as released by all the coal burned in the past 250 years.) If that happens, our chances of stabilizing the climate are virtually zero.

—**Jeff Goodell, *Big Coal***

Big Coal's goal is to keep us comfortable, not curious. It's not hard to understand why. Coal is by far the most carbon-intensive of all fossil fuels, emitting more than twice as much CO₂ per unit of energy as natural gas, and so any limits on CO₂ emissions will hit coal the hardest.

—**Jeff Goodell, *Big Coal***

An analysis released by the American Lung Association in 2004 attributed 24,000 premature deaths each year to pollution from coal-fired power plants. In addition, the research estimates that more than 550,000 asthma attacks, 38,000 heart attacks, and 12,000 hospital admissions are caused annually by power plant pollution.

—**2007 *State of the Air*, American Lung Association**

I am a Mud River West Virginia Girl! More specifically, I am a Conley Branch Girl.

I loved the mountains that surrounded our little three-room house. It was as if the mountains were there to protect us.

The mountain to the east of our house was my absolute favorite. Amongst all of the trees that are indigenous to the area stood a huge pine tree. It jutted out far beyond the top of the forest as if to say, "I am here. I will protect and shelter you from harm."

There were sad times when I sought out the comfort of the mountain. I ran to my tree when my grandmother died.

I wish I could run there today, but the mining companies came after I left. Neither Conley nor Mud River will ever be the same.

Conley is now blocked off with a "No Trespassing" sign. The mountain at the turn into Conley is even gone. No trees. No wildflowers. No squirrels. Like a lot of places in the Appalachians, nothing is left except what the mining company did not want.

I pray that those of us who love this land are strong enough to stand up for the mountains that remain. They have provided strength, solace, protection, and even life, to us. It is now our turn to return the favor.

—**Marlene Adkins Thames, iLoveMountains.org**

Operating at full throttle, the [Boardman, Oregon] power plant inhales 330 tons of pulverized coal dust an hour. That's nearly three railcars worth—stripped from open pit seams in Wyoming's Powder River Basin—every hour, almost every day, every year.

Inside the plant's 260-foot-tall furnace, 32 flamethrowing burners ignite the cloud of talcum-size coal particles into a roiling, 3,000-degree ball of noxious gases and ash.

Like a miniature sun, the ongoing eruption creates enough energy to power 280,000 homes served by the plant's part owner and operator, Portland General Electric. It's 19th-century technology. But it's reliable and cheap. Unfortunately, it's also dirty. Very dirty.

—**Ted Sickinger, *The Oregonian*, Dec. 26, 2008**

My name is Martín Macias Jr. I'm 19 years old from Chicago, Illinois. I live about two miles away from two of the biggest coal power plants in the Midwest region and the only two coal power plants in Chicago. It's responsible for about 50 deaths a year in my neighborhood, and it's responsible for toxic air, toxic soil. If you look at the demographics of these communities, it's mostly Latino working-class immigrants. It doesn't employ anyone from our neighborhood, and we don't get any energy.

—**Interviewed on *Democracy Now!*, March 2, 2009**

Our denuded hills now stretched across the valley with a haunting vacancy. It felt strange to be standing alone in an area where a dynamic community—the first settlement in [Eagle Creek, Illinois]—once thrived for two centuries. There was an air of an emptied field: of death, not life, despite the verdant spread of grass across strange ruts and broken slopes. The area looked abandoned. There was no wildlife. No people. No homes. No barns. No horses. No trees. As part of the so-called reclamation laws the coal company had replanted a type of grass, which grew in clumps like weeds. Not a single tree had been planted on our ancestral property.

—**Jeff Biggers, *Reckoning at Eagle Creek***