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**M201 Andrea Phillips, SP 2019** **Schulze, 4th Grade**

**Science Lesson Plan: How Coal Mining Negatively Effects the Environment**

**LEARNING OBJECTIVE**

Students will be able to recognize the negative effect that coal mining has on the environment.

* Students will have met the objective once they have filled out their before and after pictures of mining ‘coal’ from their cookies. Students will demonstrate their understanding of how their cookie represents our environment through small group discussions and a whole group discussion.

**STANDARDS**

● ***Content (Core Standards)***

4.ESS.2 Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.

4. ESS.4 Develop solutions that could be implemented to reduce the impact of humans on the natural environment and the natural environment on humans.

● ***Practices (SEPS - listed at the beginning of each grade level)***

SEPS.1 Posing questions

SEPS.2 Developing and using models and tools

SEPS.3 Constructing and performing investigations

SEPS.4 Analyzing and interpreting data

SEPS.8 Obtaining, evaluating, and communicating information

**TEACHER CONTENT KNOWLEDGE**

The teacher will know that mining coal is the process of extracting coal from the ground. There are two ways that coal can be extracted, either surface mining or underground mining. Surface mining is the most common form, and it is when the coal is present within 200 feet below ground. To reach this coal, large machinery is used to tear up the ground to reach the areas that are storing coal. Most times, the area where coal was extracted is semi-recovered to help restore the damage, but it takes years for life to return. Underground mining can be as deep as 1,000 feet below the ground, and it requires extensive damage to the environment. This requires the building of a mineshaft, and there may never be a restoration of the underground area. Both of these types of mining cause extensive damage to the environment including; tree/plant removal, animal habitat removal, fossil fuels produced by machinery, soil disruption, promotes soil erosion and stirs up great amounts of dust pollution (which causes damage to the respiratory system for nearby animals and humans).

Once the coal is extracted, it is sent to a processing plant to begin the many stages before it is used for energy. The coal is first cleaned to remove any impurities that would negatively impact the burning process. Then, the coal is sent through a pulverizer to break up big pieces. This will ensure that all the pieces are at a suitable size for effective burning. Once all the coal is a uniform size, it is transported for burning. It may be transferred through a truck, train, or even mixed with water to be transferred through a pipeline.

**MATERIALS** -- **Asterisk (\*)** = any materials that may be a **safety concern**.

* 3- Packs Chocolate chip cookies**\***
* 30-Blank sheets of paper
* 30-Paper plates
* 30-toothpicks**\***
* “Energy Island” Book

E) **DESCRIPTION OF LESSON**

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| **ENGAGE (5 minutes)****Focus question**: What effect does coal have on the environment? The lesson will begin with a discussion focused around the question from the end of the previous lesson. The question was “write down everything you know about coal.” The students will participate in a discussion where their answers are shared. The teacher will facilitate this discussion and will ask students to give a thumbs up or a thumbs down when they agree or disagree with each concept. This will engage the students in the topic for the day. The teacher will explain that coal is a nonrenewable resource and will introduce the activity for the day. The teacher will introduce the activity that simulates how coal is obtained from our environment. The teacher will explain that through this activity, students will be exploring how obtaining coal affects the environment. First, the teacher will explicitly explain (and model on the projector) that the chocolate chip cookies represent what our natural environment is like before mining coal. The cookie represents the ground, and the chocolate chips represent the coal embedded in the ground. The teacher will go around to each student and they will be given a cookie, a paper plate, a toothpick and a piece of paper. The students will then be asked to trace/draw exactly what their cookie looks like on their piece of paper, and make a prediction on what their cookie will look like at the end of their mining mission.  |
| **EXPLORE (15 minutes)**Students will begin to dig out each chocolate chip from the cookies using their toothpicks (simulating mining for coal). The teacher will explain that each student will independently mine for coal with their cookies, paying close attention to the difficulties they encounter, and the effects of mining on their cookies. The changes that happen to the cookies environment will be data that shows how mining negatively impacts the natural environment and cannot be restored to its original state. Students will record this data by making changes to their drawings when they have successfully extracted all chocolate chips from the cookie. The teacher will also be circulating the room to assess students thinking of their difficulties, and the immediate effects that they observe. Through the students picking the chocolate chips out of the cookies, students will be gathering first-hand evidence on how mining coal disrupts and hurts the natural environment. This will help them answer the focus question because it will give them evidence that mining for coal has a negative effect on the environment. Through the explain portion of the lesson, they will be able to tie their evidence to develop a claim and reasoning to fully answer their focus question.  |
| **EXPLAIN (10 minutes)** The teacher will facilitate a discussion to review what was found. The teacher will request that 3-4 students share their reflections and responses to the activity. The teacher will also ask if their cookie will ever look like it did before they mined. Using think pair share, the teacher will ask the students how this activity relates to renewable and nonrenewable energy. The teacher will clarify that the cookie represents the environment and the chocolate chips represent the coal, and overall the process of mining has negative effects on the environment that cannot be healed. During the discussion, the teacher will also ask “what are other ways that using coal affects the environment?” to prompt students to think about burning coal and the production of fossil fuels. The big idea from this lesson is that using coal (nonrenewable resource) as energy is detrimental to the environment through the process of obtaining the resource and through burning coal. This is proven through the work students did with the chocolate chip cookies, because they had to destroy the cookie to obtain the resource.  |
| **ELABORATION (10 minutes)**For this section of the lesson, we will be reading out loud a picture book called *Energy Island,* which focuses on one island’s resources that are renewable and efficient. The teacher will read the book to the students, with discussion questions and prompts along the way to engage students in the concepts. These questions will look like “how is this energy better than coal?” or “in what ways do renewable energy benefit this town?” These questions will prompt students to connect the ideas from the chocolate chip cookie assignment with the concepts presented in the text, which involve renewable resources and the implementation of these in a town. These concepts will appear in the following lesson, so this will provide the students with a strong framework to begin considering these ideas. Link to [book](https://www.amazon.com/Energy-Island-Community-Harnessed-Changed/dp/1250056764/ref%3Dasc_df_1250056764/?tag=hyprod-20&linkCode=df0&hvadid=312087669297&hvpos=1o1&hvnetw=g&hvrand=16296547970058109376&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=1017003&hvtargid=pla-492241870769&psc=1) on Amazon. |

**ASSESSMENT/EVALUATION (the 5th “E”)**

**Formative:** A formative assessment here will take place during the read aloud. The students will be asked questions about the topic of nonrenewable and renewable resources. They will be asked discussion questions during the text to determine the student understanding at this point. We will be looking for students to answer with insightful answers that include the content covered in class, which is information on the harmful effects of nonrenewable resources.

**Summative:** For a summative assessment, the students will write down the answer to a question on a piece of paper for an exit slip. The question will ask them which the better choice is- renewable or nonrenewable? They will also be instructed to answer, “if your answer is the obvious choice, then why aren’t we as people using this more for energy?” This will assess the student thinking because it will see if the students are thinking of the content taught in class in combination with some information learned from the book.

**DIFFERENTIATING INSTRUCTION**

**Science Content/ideas**– In order to gear up this lesson, we can ask students to take this a step further and pursue research on their Ipads to see what happens to coal when it’s processed. This would help them further instill the idea of the nonrenewable aspect of coal as a source of energy. This would also clarify the connection of the cookies to the action of mining for coal, which would enhance student understanding of the content. To gear down this lesson, we may have to assist the students in making connections to how the cookie is representative of the environment. The teacher may have to adjust and provide explicit instruction to help students develop their ideas if they are not able to do it on their own.

**Science Practices and/or Attitudes Conducive for Science Learning**– Students may become rowdy since this will be a fun activity, so the teachers may have to give reminders to stay on task. If students go very quickly and get out all the chocolate chips from their cookies, we may either given them another cookie to work on, or we will ask them to begin writing down their reflections on how the removal of the chocolate chips affected the environment of the cookie. This will give them more time to make connections to how the cookie and our environment compare.

**HANDOUTS/JOURNALS**

* <https://www.calacademy.org/sites/default/files/assets/docs/pdf/062_fossilfuelschocchipminingworksheet_8x11.pdf>
* <https://docs.google.com/document/d/1_efM0DN6GH9oPKJ578WrJfWe765QXDrsn7iPbXnn7Ok/edit>

**REFERENCES - List ALL**

* <https://www.calacademy.org/educators/lesson-plans/fossil-fuels-chocolate-chip-mining>
* [https://www.amazon.com/Energy-Island-Community-Harnessed-Changed/dp/1250056764/ref=asc\_df\_1250056764/?tag=hyprod-20&linkCode=df0&hvadid=312087669297&hvpos=1o1&hvnetw=g&hvrand=16296547970058109376&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=1017003&hvtargid=pla-492241870769&psc=1](https://www.amazon.com/Energy-Island-Community-Harnessed-Changed/dp/1250056764/ref%3Dasc_df_1250056764/?tag=hyprod-20&linkCode=df0&hvadid=312087669297&hvpos=1o1&hvnetw=g&hvrand=16296547970058109376&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=1017003&hvtargid=pla-492241870769&psc=1) (link to book used in read aloud)