



Bringing Mining and Environmental Engineering to PreCollege Classrooms

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Dr. Barbara Moskal is a Professor of Applied Mathematics and Statistics and the Director of the Trefny Institute for Educational Innovation at the Colorado School of Mines. She is also a senior associate editor of the Journal for Engineering Education. Her research interests includes: K-12 outreach, STEM education, measurement, assessment, outreach, and diversity.



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(Curriculum Exchange)**

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Program Website

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Program Summary

The lesson plan that is proposed for presentation here was created as part of a larger, kindergarten through twelfth grade (K-12) outreach program. A unique feature of this program is the inclusion of all grade-levels, K-12, within a given district. Additionally, this program is modeled after a National Science Foundation GK-12 program, which was originally funded over ten years ago. The lesson presented here targets grades 5 through 8. Teachers who participate in this program attend a two-week summer workshop which is taught by our faculty and which addresses cutting edge research in a hands-on and friendly manner. Topics covered include, energy resources, water, and the Earth. Throughout the academic year, graduate students, who are assigned to assist between one and three teachers, provide up to 15 hours each week of direct classroom support. During this period, they assist in the instruction of STEM lessons, lead hands-activities, and work with small groups of K-12 students. The graduate students also participate in various outreach events throughout the school year that include judging science fairs and participating in school science nights.



Example Lesson

Target Grade: 5-8

Objective: To have students understand mining and coal. Mining engineering is important because many of our natural resources are buried under the ground and need to be dug up. One such resource is coal, which is a nonrenewable resource used to produce energy. Mining engineers need to think about how to remove resources safely and effectively. Mining operations, however, can have a devastating impact on the environment and the land must be restored to a usable purpose (a process called reclamation).

Activity:

1. Tell students are starting their own coal mining company that they will 'mine' chocolate chips out of a cookie. Students will use a worksheet to keep track of costs and profits. This will incorporate math topics such as addition, subtraction, and multiplication. Higher levels can work with prices that contain decimals. First they must pay for their property (cookie). Hand out cookie and graph paper to the students. Students are to then draw a circle of their cookie on the graph paper. Explain to students that they must reclaim their land at the end and any crumbs that are not back in the circle will have an associated penalty.
2. Next student must decide which and how many pieces of equipment they want to use to remove chocolate chips, each with its own cost. Hand out desired equipment (tooth pick, paperclip, etc.).
3. Have student begin to mine out chocolate chips (~10-15 minutes). After mining is complete, squares outside the circle with crumbs are counted and added to costs.
4. Students will calculate their costs (cookie, equipment, crumbs), their profits by counting all of their mined chocolate chips and their net profit.

