LESSON PLAN

Precious Metal Mining

GRADE

Math:

3 (NL)
4 (AB, BC, NB, NL, NS, NT, NU, ON, PE, SK, YK)
5 (MB)
6 (MB)

Cycle 1 (QC)

Science:

3 (AB, NT, NU)
4 (ON, MB, NB, NL, NS, PE, SK)
7 (BC, YK)

Cycle 3 (QC)

SUBJECT

Math and Science

TIME NEEDED

100 minutes (total)

• Motivational Hook (15 minutes): Inside a Gold Mine
• Open (15 minutes): Recall and Modelling
• Body (20 minutes): First 50 Minute Session: Completion of Bar Graph Activity
• Body (30 minutes): Second 50 Minute Session: Reflection/Conclusions Activity
• Close (20 minutes): Presentation of Results/Conclusions

VOCABULARY

• Extraction
• Mine Waste
• Precious Metals
• Tally Chart
• Bar Graph

LEARNING OBJECTIVES/OUTCOMES

Working collaboratively in groups students will:

• Calculate the total value for each ‘mined’ metal and the amount of waste created using their tally charts from the Birdseed Mining activity.
• Graphically represent the relative values of each metal compared to the amount of waste created on a bar graph.
• Construct meaning from their results by drawing logical conclusions and present their results to their classmates.
• Through discussion and reflection, assess the usefulness of these minerals to humans as opposed to the ‘costs’ of extraction.

MATERIALS REQUIRED

• Tally charts resulting from Birdseed Mining activity
• Poster paper/markers/masking tape or clips
• Math Learning Carpet
• Overhead projector
• Transparent 10 frames
• Manipulatives (10 frames)
DESCRIPTION OF ACTIVITY
For centuries human beings have relied on the extraction of non-renewable precious metals and minerals to provide the raw materials for tools, weapons, pottery, jewellery, objet d’ arts, buildings, electronics and modes of transportation. Currently mining activities led by multinational corporations span the globe in pursuit of the raw materials required to support our lifestyle. In the process of extraction, literally tons of rock and ore waste are produced for minimal return leaving behind significant negative impacts on the environment. For example, mining gold to produce a single, .33 ounce, 18 karat gold ring creates 18 tons of waste!

This lesson should be performed toward the middle-end of the academic year when students have achieved a higher level of proficiency working collaboratively in small groups and in application of the problem-solving model. Prior to this lesson, students will have investigated the characteristics of rocks and minerals and explored how society uses them. They will have explored the topics of how mining works, what forms it takes and its impact both in terms of commerce and the environment. Critical to the success of this lesson is completion of the Birdseed Mining activity (http://nesen.unl.edu/Lessons/Geosphere/birdseedminingactivity.asp).

Based on data gathered in tally charts during the Birdseed Mining activity, students will work in groups to calculate total values of precious metals and waste and organize their data on bar graphs. They will then interpret and communicate their results to their peers.

Motivational Hook (15 minutes): Inside a Gold Mine
As students are settling, instruct them to return to their groups from the Birdseed Mining activity along with their tally sheets and 10 frames. (Poster paper and markers are already at the tables.) Once children are settled, briefly recall the mining activity, the Triceratops story and what metals they extracted from their mines. Explain that in the next portion of the lesson they will determine what their precious metals are worth!

Open (15 minutes): Recall and Modelling
Through a combination of direct instruction and modelling, walk through a sample problem using transparent 10 frames to determine the total value of one metal using the number of units from the tally sheet and multiplying it by the dollar value.

- Have children utilize 10 frames to perform problem as teacher models.
- Have example displayed on Math Learning Carpet and direct children to reference that as well as their 10 frames if they are stuck.
- Recall the development of a bar graph, cueing students to provide answers on correct labelling and display of data, drawing a sample on the board as they interact.
- Continue as a class to transfer the solution for one metal and represent it on the bar graph.
- Instruct students to complete the rest of the calculations for the remaining metals, displaying the results on a bar graph to be drawn on the poster paper provided.
- Instruct students that in the next session, they will be reflecting on their results and drawing conclusions related to the key question, ‘what is the impact of mining for precious metals in terms of waste compared to the total value of metal extracted’.
- If they finish their bar graph prior to the end of this session they may move on to that activity. They may choose one person to present their results to the class.
- Remind students of the lesson goals and how they will be assessed.
- Ask for clarification questions.

Body (20 minutes): First 50 Minute Session: Completion of Bar Graph Activity
Group Work:
- Students calculate the total values for each precious metal and the total value of all precious metals.
- Students calculate the total value of waste.
- Students plot their results on a bar graph (use large poster paper). (They may choose to do two bar graphs, one displaying the results of each metal against total waste, the other displaying total value of all metals against total waste.)
*Allow use of manipulatives for calculations as well as reference to the Math Learning Carpet. For those students not yet ready for a bar graph, they may use pictographs to represent their data.

**Body (30 minutes): Second 50 Minute Session: Reflection/Conclusions Activity**
- Use 10 minutes of this time to settle students in their groups and re-orient them to the activity.

  In this phase:
  - Students discuss their data and draw conclusions of mine waste created vice the value of precious metals extracted.
  - Students hang their poster paper on the wall and prepare to present/discuss to larger class.
  - If students finish early, they may choose to discuss how to apply what they have learned through this activity to affect positive change in the mining industry. They may also discuss how they as humans can reduce their need for products that contain precious minerals (i.e., reclaim existing minerals from used materials such as computers, cars, cell phones, IPods, etc...) or whether they think that is necessary and why.

**Close (20 minutes): Presentation of Results/Conclusions**
- Each group presents their results using math language.
- Teacher led discussion on conclusions drawn based on our data, what we currently know about mining, the difficulty of extraction, and the amount of waste created vice the value received through the precious metals obtained.
- A small portion of this time can also be spent on reflection of the group process and how well the students felt they worked together.
- The students will be assigned a reflective writing in their math journal to describe how they used data management to address the essential question and how they can apply data management to draw conclusions about the world around them.

**ASSESSMENT**
Student achievement shall be assessed against the defined lesson goals in the following manner:
- Problem Solving/Thinking – During the initial group activity, the teacher shall perform a walk-around, observing and recording students’ use of the problem-solving model and critical thinking displayed as they calculate totals and apply their data to bar graphs. Students’ ability to work in groups will also be assessed.
- Oral Communication – During the presentation activity, those selected to present will be evaluated on their oral communication skills, their use of math language and their ability to communicate their group’s results. (Those students not presenting will be provided an opportunity for evaluation in oral communication during another activity.)
- Application – Reflective writing - Students will be evaluated on their ability to connect and extend what they have learned through this data management activity to the world around them through evaluation of their math journals. Some students will be offered an opportunity to conference orally with the teacher as opposed to writing in their journals.

**PRINT AND WEB SITE REFERENCES**
• Kadel, B. Birdseed Mining Activity. (University of Nebraska – Lincoln: Nebraska Earth Systems Education Network School of Natural Resources). Retrieved on September 26, 2009 from http://nesen.unl.edu/Lessons/Geosphere/birdseedminingactivity.asp.
• http://www.earthworksaction.org
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