

## Grades 6 – 8

**Time Frame: Three 45-60 minute sessions (times can be easily modified)**

**AIM: How can we help the Balang community store water for irrigation?**

### USEFUL PRIOR KNOWLEDGE:

- Background on Cambodia (available materials, poverty, and culture)
  - EWB Cambodia Link (location, photos, current design): <http://ewbnycambodia.blogspot.com/>
  - Human Translations (Villagers): [http://www.humantranslation.org/Gal\\_Balang/index.html](http://www.humantranslation.org/Gal_Balang/index.html)
- Background on Dam Design
  - Building Dams: <http://www.teachersdomain.org/resources/eng06/sci/engin/design/littledam/index.html>
- Visuals of dams that are familiar to students
  - New Orleans Levee break: <http://soundwaves.usgs.gov/2006/01/>
  - Hoover Dam: <http://www.pbs.org/wgbh/buildingbig/wonder/structure/hoover.html>
  - Three gorges dam: [http://www.pbs.org/wgbh/buildingbig/wonder/structure/three\\_gorges.html](http://www.pbs.org/wgbh/buildingbig/wonder/structure/three_gorges.html)
- Engineering Process
  - Worksheet link

**LEARNING OBJECTIVES:** *Aligned with Massachusetts standards for tech/engineering, Grades 6-8*

- Follow and explain the engineering process to determine best solution
- Identify appropriate materials and tools for dam construction
- Explain difference between dam designs (Arch, Buttress, Embankment, Gravity) and determine which is preferable for the dam in Balang Commune
- Communicate your solution through written, oral and visual presentation
- Explain why the dam chosen will be best for the community now and in the future

### GUIDING QUESTIONS (GQ):

1. What challenge do the Cambodian people face?
2. What does the community need and what can they offer?
3. What is the difference between dam designs: Arch, Buttress, Embankment, Gravity?
4. List possible materials and structures that should be used for dam.
5. Describe the best solution and explain why you chose it?
6. How will you build your model dam?
7. How did your dam perform under water pressure?
8. What will you do differently next time to improve your dam?

### LESSON PLAN / ACTIVITIES:

**Materials:** Engineering Process Worksheet(s), Wet sand, modeling clay, aquarium gravel (optional), popsicle sticks, Styrofoam trays, cardboard, water, small plastic tubs, plastic cups (for water or scooping sand), scissors, masking tape, drawing paper (white printer paper), crayons, paper towels for clean up, paper and tape for labels.

#### **Day One: Research and Dam Design!**

**Task One: 5-10 minutes** Present Cambodia Situation to students—read situation, show visuals and have students respond to the following question in first box on their **engineering design**

**process worksheet.** Discuss responses as a class and record most succinct response on class poster of Engineering Process.

1. Identify the need/problem: What challenge do the Cambodian people face?

**Task Two: 30 minutes** In teams of at least four, students should research the community—people, environment, housing, needs, resources, ect. Information and visuals should be provided or internet should be available for student research. Information should include the following: maps, photos of community, natural environment, housing, river, dams (others in Cambodia and familiar local dams)

Students explore situation in Cambodia record information that may be useful for planning a solution.

2. Based on your research, what does the community need and what resources do they have to offer?
3. What is the difference between dam designs: Arch, Buttress, Embankment, Gravity?
4. List possible materials and structures that should be used for dam.

**Suggested Websites:**

- EWB Cambodia Link (location, photos,current design):  
<http://ewbnycambodia.blogspot.com/>
- Human Translations (Villagers): [http://www.humantranslation.org/Gal\\_Balang/index.html](http://www.humantranslation.org/Gal_Balang/index.html)
- New Orleans Levee break: <http://soundwaves.usgs.gov/2006/01/>
- Dam Vocabulary: <http://water.nv.gov/Engineering/Dams/Glossary.cfm>
- Dam Basics: <http://www.pbs.org/wgbh/buildingbig/dam/basics.html>

Keep thorough records of preferable materials and designs! The more your research and understand the situation now, the smoother it will be to find the best solution.

**Task Three: 5-10 minutes** Compare research with neighboring teams. Add useful and novel findings of your neighboring team (include where they found the information i.e. website link) Which materials are preferable considering strength, availability, constructability, cost, ect?

**Recap: 5-10 minutes** In journal, describe top three solutions and why you chose them. Share with class.

**HOMEWORK** Dam building competition tomorrow! Tonight for homework, choose the best design and record it on your engineering process worksheet. (You may further research at library or online.)

### **Day Two: Building the Dams**

*Set up: Set up tub stations with wet sand sloped to one side. Don't wet the sand too early or it may dry out. Students should sit with teams. Each team receives a tool set—including at least one empty plastic cup, 10-15 popsicle sticks, one plastic cup full of grave (optional), one plastic cup full of soil (optional), one Styrofoam tray, one square of card board at least 6" square, one block of modeling clay, scissors, masking tape, metal paper clips, string, and engineering or graph paper. Provide water when the dam is ready for testing.*

**Task One: 10-20 minutes** Dam Design! Each member of team should share the design they chose and why s/he chose it. Then, each team picks one design to draft (draw) and build. When the design is picked, teams should answer the following questions on their engineering design

process worksheet and then draft the design on engineering (or graph) paper, labeling materials and dimensions.

5. Describe the best solution and explain why you chose it?
6. How will you build your model dam? *Consider: materials, tools needed, time, members of group—who will do what. The plan should be easy to follow so that design can run smoothly.*

**Task Two: 30 minutes** Dam building competition! Teams will first mold a stream/river in the wet sand. The teams will build a small model of a dam that spans the river. The dams should hold the water back without leaking and without falling down.

**Recap: 5-10 minutes** Review dams that have been constructed: How are the dams the same? Different? What dam designs were used? What materials were used? Why did the teams choose the designs and materials they used?

### **Day Three: Testing the Dams**

**Task One: 25-30 minutes** Teams share their dams with the class by pouring water through the river and answering the following questions:

- What design and materials were used? Why?
- What were the victories and challenges of our team?
- What will we do next time?

**Task Two: 10-15 minutes** Teams should report back together and discuss the final questions on their Engineering Processing Worksheet.

7. How did our dam perform under water pressure?
8. What will we do differently next time to improve your dam?

**Task Three: 10-15 minutes** Individually, students should then use their research and experience to write a letter to EWB communication your suggestions for the community—consider materials, structural design, human resources.

### **Forms of Assessment:**

Oral answers to guiding questions

Worksheet—Engineering Design Process

Physical Dam built by teams

Team share

Follow up questions

Final presentations (written, poster and oral)

Self Assessment—Victories? Challenges? Next time?

Letter to EWB