

Grades 3 – 5

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

AIM: What materials should the people of Balang Commune to use to build a dam?

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
- Discuss irrigation and potential water sources. Links include:
 - Irrigation lesson discussion points: <http://esci.unco.edu/water/wtrwise/6t.htm>
 - Introductory background information:
<http://home.howstuffworks.com/irrigation.htm>
- Background on Dam Design
 - <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/hover.html>
 - Three gorges dam:
http://www.pbs.org/wgbh/buildingbig/wonder/structure/three_gorges.html
 - Beaver Dams: http://www.fgmorph.com/fg_8_14.php

LEARNING OBJECTIVES: *Aligned with Massachusetts standards for tech/engineering, Grades 3-5*

- Explain the challenge that the community is facing and develop possible solutions
- Represent problem /solution in different ways—sketches, graphic organizers, diagrams, and lists
- Examine different materials used for dam design (based on strength, hardness, and availability)
- Determine appropriate materials and tools for dam construction
- Show how the people of Balang Commune can build the best dam
- Explain why the material 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 possible solutions could they use to help their irrigation problem?
3. What kind of dam do you think the people of Balang Commune should build? Why?
4. What materials should the Cambodian community use for their dam?
5. How can the community build the dam?
6. Represent the problem and a solution using either a sketch, graphic organizer, diagram, or list.

7. Why was your idea good for the community now and in the future?

LESSON PLAN / ACTIVITIES:

Materials: Wet sand, modeling clay, aquarium gravel, popsicle sticks, Legos, Construction Paper/ cardboard, erector set (optional), water, tables/desks, small plastic tubs, plastic cups (for water or scooping sand), scissors, masking tape, drawing paper (white printer paper), crayons, paper towels for clean up.

Set up (Task 3): Set up a plastic tub with wet sand. Divide students into teams of at least four. Each team receives a different kind of material (ex. Legos, popsicle sticks, paper, clay, etc.) and must build a small model of a dam.

Day One (60 min):

Task One: 5-10 minutes Present Cambodia Situation to students—read situation, show visuals Location, aerial photographs, current design: <http://ewbnycambodia.blogspot.com/>
Villagers: http://www.humantranslation.org/Gal_Balang/index.html

1. What challenge do the Cambodian people face?
2. What possible solutions are there for their irrigation problem?

Task Two: 10-15 minutes After students have offered a dam as a possible solution for GQ #2, show them visuals of dams that are familiar to students—local dams or other well known dams. Vary dam choice so that students become familiar with large and small scale dams. *Possible questions/comments for students: Let students comment on dams they know about or have crossed themselves. What is the purpose of a dam? Ask them what they remember about the dams. Was the dam big or small? Was it curved or straight? Could they see supports? If not, how can they think of a way for the dam to stand up? What did the dam stop, a river, a stream? Was it made of metal, concrete, stone, wood? Did it seem safe? **Have students draw / label dam to answer below question:***

3. Link back to Cambodia: What kind of dam do you think the people of Balang Commune should build?

Possible questions/comments for students: What are the people going to be doing with the water from the dam reservoir? What about weather? Could heavy storms damage the dam? What about humidity? Very dry and brittle weather? Will the dam also be used as a walkway? What might the villagers carry across the walkway? Would animals also cross (horses, mules, ect.)? How will the horses/mules hoofs affect the dam? What kind of surface might be needed to withstand feet, tires, or wooden wheels? How wide are their carts? Car? Trucks? Buses? How heavy? What will make it safe as a walkway?

Task Three: 25-30 minutes Construct a model dam in teams of at least four students. When choosing teams consider including students with different strengths in each group—If roles are assigned / chosen, use engineering titles (ex. project manager, designer, drafter, presenter). Teams must build a small model of a dam that spans the river and holds back water but allows some water to pass in a controlled way.

Team Share / Recap: 5 minutes Teams share their dams with the class by pouring water through the river and answering the following questions:

- What materials did our team use?
- What were the advantages and disadvantages of using this material?

Teacher records responses from what on the below poster and elicits material, advantages, and disadvantages from students.

	Material	Advantages	Disadvantages
Legos	Plastic		
Popsicle sticks	Wood		
Clay	Clay/mud		
Gravel	Rocks		
Const. paper/Cardboard	Paper		
Erector set (optional)	Metal		

Day Two:

Review and Extend: 5-10 minutes Dams and Advantage / Disadvantage poster are out from previous day. Teacher asks students to vote: After seeing all the dams, which is best and why? Are there any other materials that could have been used? Besides materials, what else did we need to build our dam?

Task One: 5-10 minutes What materials are available in the community in Cambodia? Use pictures to explore each of their characteristics for dams.

- EWB Cambodia Link (location, photos, current design):
<http://ewbnycambodia.blogspot.com/>
- Dam Design:
<http://www.teachersdomain.org/resources/eng06/sci/engin/design/littledam/index.html>
- What materials could the Cambodian community use for their dam?

Possible questions/comments for students: Does the community have materials near their home—in nature? Or will they have to have materials shipped in? How much money will they have to spend on materials? Do they have the tools, strength and knowledge of how to use the materials to construct dam? If not, how will EWB help?

Task Two: 25-30 minutes Final Project—In teams, students create a “proposal” for project that would be submitted to Engineering Without Borders. The proposal must explain the problem and their solution (consider the below questions when explaining the solution) using sketch, graphic organizer, diagram, or list. (link to worksheet) Rough proposal can be written on worksheet, and then transferred to poster paper that will be used for presentations.

5. How will the community build the dam?

Possible questions/comments for students: How many people are in the community? Are there enough people old enough and strong enough to construct the dam? How will they cooperate? How will they decide who does what, and who's in charge of what?

6. Represent the problem and a solution using either a sketch, graphic organizer, diagram, or list.

Teacher—show poster examples of sketches, graphic organizer, diagram, or list and student groups may choose method for their group's explanation.

Posters: <http://www.swarthmore.edu/NatSci/cpurrin1/posteradvice.htm>

Sketches: <http://pergatory.mit.edu/2.007/Resources/drawings/>

Teacher should provide groups with print out of the example for the method they have chosen. Teacher should walk around to each group and answer questions/give feedback on their explanation. *If the presentation tools are unfamiliar to students modify by using technique that students are already familiar with.*

Presentations / Recap: 5 minutes Each group will present their proposals to the class. (Optional: Class can vote on which proposal to use.)

Final Journal: 5 minutes Why was your idea good for the community now and in the future?

Forms of Assessment:

Oral answers to guiding questions

Physical dam built by teams

Team share

Follow up questions

Final presentations (written, poster and oral)