

FARMING IN ANCIENT MESOPOTAMIA: AN ANCIENT CIVIL ENGINEERING PROBLEM

[A Design Challenge Unit by Alie Victorine Windmill Springs Elementary School, San Jose, CA](#)

Farmers in ancient Mesopotamia faced many challenges. As a result they developed new technologies to control the water coming into their fields. In this integrated, multi-day challenge, students will explore simple machines, transportation of materials, and river systems using stream tables. They will discover the problems ancient farmers faced and design their own working models that will attempt to solve those unique problems.

Grade Level: 6th

Educational Outcomes:

1. Students will identify the 3 major obstacles to farming along the Tigris or Euphrates Rivers: drought during growing season, flood during harvest season damaging crops and homes, and transportation of water to the fields during times of low water.
2. Students will design and build a working model that attempts to solve all three of these problems. Models will include a working river system, model farm and town.
3. Students will gain an understanding of how humans modify their environment.
4. Students will gain an understanding of how rivers are dynamic systems that erode and transport sediment, change course, and flood their banks in natural and recurring patterns.
5. Students will show their understanding of the problems faced by ancient farmers by writing a short expository essay that describes the problems and proposes possible solutions.
6. Students will explore simple machines as they design and build contraptions to transport materials.

Overview of the Project and Estimated Time:

This is a multi-day project that was originally designed for a self-contained classroom where an hour to two hours a day could be devoted to the project. It could definitely fit a 50-minute period, although some “days” may take 2 periods.

Exploration Stage:

Day 1: **Design Challenge #1: Flowing From Here to There.** Students explore how to use simple machines to transport dry, but fluid, material from one container to another.

Day 2: **Inquiry Lesson: Stream Table Explorations.** Students are introduced to the stream tables (either store bought or class-made.) They are given time to explore and observe how river systems change over time. This can be a free exploration or a more directed activity. River features such as head, mouth, deltas, sediment load; rapids, flood and drought are developed through exploration and subsequent discussion.

Clarification Stage:

Day 3: **Design Challenge #2: Two Rivers Ran Through It.** Students read the information provided on the geography and climate of the Fertile Crescent. They identify new vocabulary, connect what they are reading to the river systems, and

Teaching Notes:

This project is modeled using the Learning Cycle model of instruction. The cycle has three main parts: exploration, clarification and elaboration. Exploration engages students, gives them common experience and spurs curiosity. The clarification stage allows students time to reflect on what they have learned, synthesize, attach new vocabulary to the experience and negotiate meaning. The elaborations stage has students taking their new knowledge and applying it to a new problem.

Language Arts

Connection: It is recommended to have students read (or read aloud to them) the beautifully written and illustrated trilogy of books by Ludmilla Zeman retelling the epic story of Gilgamesh.

identify the problems that ancient farmers faced. Working in teams, students begin to brainstorm possible solutions for each of the problems.

Optional: **Writing Component:** Taking on the role of an ancient civil engineer, students compose an essay that identifies the problems and proposes solutions. Included with this is a sketch or diagram of their proposed solution. These are delivered to the King/Queen of the City-State (teacher) for approval. (This can be individual or group work)

Elaboration Stage:

Day 4 & 5: **Model building:** Students build a working model of a river system that solves the problems of drought during planting season, flood during harvest season, and basic transportation of water to the fields. A city and field must be included in the model. The city must be protected from floods.

Day 6: **Presentation and testing of models:** Students explain their design to the class and describe how it solves the challenges presented above. Then the rain god/goddess (teacher) brings forth the rain, going through both flood and drought seasons.

Clarification Stage revisited:

Day 7: **Evaluation:** Students write a description of their final project, evaluating it both for successes and failures and proposing possible solutions for the failures. Students then read how the Ancient Mesopotamians solved these same problems and compare their solutions to the historical accounts.

California Science Standards Connections: Grade 6 (Earth Science) - Shaping the Earth's Surface

2. Topography is reshaped by weathering of rock and soil and by the transportation and deposition of sediment.

2a Water running downhill is the dominant process in shaping the landscape.

2b Rivers and streams are dynamic systems that erode and transport sediment, change course, and flood their banks in natural and recurring patterns.

2d earthquakes, volcanic eruptions, landslides, and floods change human and wildlife habitats.

All Grades: Investigation and Experimentation: Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations.

California History-Social Science Connections: Grade 6 - Ancient Civilizations

6.1.c. The climatic changes and human modifications of the physical environment that give rise to the domestication of plants and animals.

6.2 Students analyze the geographic, political, economic, religious, and social structures of the early civilizations of Mesopotamia, Egypt and Kush.

6.2.a. Locate and describe the river systems and physical setting that supported permanent settlement and early civilizations.

6.2.b. Research the development of agricultural techniques that permitted the production of economic surplus and the emergence of cities as centers of culture and power.

Language Arts: Reading and Writing

California Language Arts Connections: Grade 6 Reading and Writing

Reading Comprehension (Focus on Information Materials):

2.0 Students read and understand grade-level appropriate material. They describe and connect essential ideas, arguments, and perspectives of text, and they relate text structure, organization, and purpose.

2.3 connect and clarify main ideas, identifying their relationship to other sources and topics.

Writing Applications (Genres and Their Characteristics)

2.0 Students write narrative, expository, persuasive, and descriptive text.

2.2 Write expository compositions (e.g., description, explanation, comparison/contrast, and/or problem solution) that state the thesis or purpose, explain the situation, follow and organizational pattern appropriate to the type of composition, offer persuasive evidence for the validity of the description, proposed solutions.

Design Challenge #1 Flowing From Here To There (Day 1)

In this mini-challenge students build a machine to transport water from a river to a field. This introductory challenge will prepare them for the transportation problem they will need to solve in the more extensive model building challenge later on in the week. It allows them to explore the idea of transportation and then either use their successful design or redesign it for their model.

Grade Level: 6th

Educational Outcomes:

1. Students will gain an understanding of how humans modify their environment.
2. Students explore simple machines as they design and build contraptions to transport materials.

Estimated Time: 1 class sessions (50 minutes)

MATERIALS AND SET-UP

Large Dishwashing Tub for the river
Cookie sheet for the field
Bean bag material, rice, small light gravel
(Anything that will flow like a liquid but be easy to clean up)

Provide a variety of materials that would lead to different solutions such as:

Cardboard or tagboard
Plastic caps, margarine tubs, film canisters, plastic or paper bags cardboard tubing (toilet paper, paper towel, wrapping paper)
Wheel like objects
Cans
Dowels
rubber bands, string, straws

Tool Table:

Saws, drills, tape, mitre boxes, scissors, meter sticks,
Glue guns

Research Table:

Books /posters/web sites on simple machines. A handout on simple machines might be useful. Students are not allowed to research ancient civilizations and their solutions.

Set Up:

Students should be organized into groups of no more than 4

Materials and Organization:

Tool Table: include a sawing area and a gluing area

Resource/ Supplies Table: All materials should be set out on a table that is easily accessible. Special consideration should be given to the sand or kitty litter and how it will be distributed to each group. Pre-bagging it in gallon plastic bags would greatly assist the distribution.

Student Work Area: Ideally students would be able to work outside, where spills can be more easily cleaned up. Inside use plastic drop cloths under their work areas.



A. FLOWING FROM HERE TO THERE

Scenario:

Transportation of water from rivers to fields in an easy manner was a problem for early farmers. They certainly didn't want to carry it all by hand. Using only simple machines they created methods or devices to move water.

Challenge

Create a device that will move the most water (bean bag stuffing, or rice or some dry solid that flows) from the river to the field that is 1 meter away from the river to the field.

Constraints

- "Water" may not simply be carried or moved by hand.
- The device may be hand operated. It doesn't have to work by itself, although it could.
- The "water" must stay clean, so no hand or other human body parts may enter the river.
- You may not reposition the river once the teacher has placed it.
- You have 30 minutes to design, build, and redesign your device.
- You will be given only 3 minutes to move all of the "water" from river to field.
- Remember water is precious - be very careful of spilling.
- Since we don't want to flood our field, you may not test your device until the official test.

Design Challenge Testing and Demonstration:

Students will have 3 minutes to move "water" from the river to field. They will be timed. Fast is good, but moving it without spilling is better. Students must identify the simple machines that their device uses

Teacher note: Have students present what they hope their design will do before actually trying it. After testing you can allow them a moment to think of ways they might have changed it.

Teaching Points to Guide Reflection Questions:

Students should be able to discuss their approach to solving the challenge and the simple machine(s) that they chose to incorporate.

Facilitator's Questions (to be asked during the team exhibition)

- Are you concentrating on moving the material quickly or carefully?
- How are you going to prevent spills?
- What simple machines are you using? How are they helping?
- Did you do any research to inform your design? How did it help you?
- If you had more time what would you add, change, or do differently?

Reflection:

After the demonstrations and cleanup, students and instructor should decide which designs were successful and in what ways. Discuss what simple machines seemed to work best or were most commonly used and why. Students should be given time to reflect on how they would change their designs.

C. EVALUATION: See attached Rubric

D. HANDOUTS

Student Handout: From Here to There
Evaluation Rubric

Teacher Notes:

Decide how you are going to place the river system. You might want to use gravity to your advantage by placing the river system on a block OR let students arrive at the solution that they can place their field in such a way to harness the force of gravity. This is one of the great advantages of design challenge- it allows students to think outside the box by playing with the rules.



E. RESOURCES

Web Sites:

Brainpop: Simple Machines

<http://www.brainpop.com/tech/simplemachines/>

Thinkquest: Simple Machines

<http://library.thinkquest.org/J002079F/sub3.htm>

Townsville Primary School: Simple Machines

<http://www.smartown.com/sp2000/machines2000/>

"Inquiry Almanack": Simple Machines

<http://sln.fi.edu/qa97/spotlight3/spotlight3.html>

Student handout

Flowing From Here to There

Scenario:

Transportation of water from rivers to fields in an easy manner was a problem for early farmers. They certainly didn't want to carry it all by hand. Using only simple machines they created methods or devices to move water.

The Challenge:

Create a device that will move water (bean bag stuffing, or rice or some dry solid that flows) from the river to the field, which is 1 meter away, in as short a time as possible.

Constraints:

- Water may not simply be carried or moved by hand
- The device may be hand operated. It doesn't have to work by itself, although it could.
- The water must stay clean, so no hand or other human body parts may enter the river.
- You may not reposition the river once the teacher has placed it.
- You have 30 minutes to design, build, and redesign your device
- Remember water is precious - be very careful of spilling.
- Since we don't want to flood our field, you may not test your device until the official test.

Testing:

You will have 3 minutes to move your "water" from the river to field. You will be timed. Fast is good, but moving it without spilling is better. Each group member will need to identify any and all simple machines that you use in your design.

Materials:

Tub for the river

Cookie sheet for the field

You will be provided with a variety of materials to create your device

Research:

Books /posters/web sites on simple machines. You are not allowed to research ancient civilizations and their solutions.

<http://www.brainpop.com/tech/simplemachines/>

<http://library.thinkquest.org/J002079F/sub3.htm>

<http://www.smarttown.com/sp2000/machines2000/>

<http://sln.fi.edu/qa97/spotlight3/spotlight3.html>



Evaluation Rubric

Building A Device: **Flowing From Here to There**

Teacher name: _____

Student Name _____

CATEGORY	4	3	2	1
Function	Device moves all material in under 3 minutes and with little spillage	Device moves majority of material within 3 minutes and with little spillage	Device moves some material within 3 minutes. Spillage may be a problem.	Device either does not move material or spills most of it.
Scientific Knowledge	All group members can identify simple machines in their design and articulate the mechanical advantage of their construction.	All group members can identify simple machines in their design and the majority can articulate the mechanical advantage of their construction.	Majority of group members can identify simple machines in their design and some can articulate the mechanical advantage of their construction. Explanations by most group members indicate a basic understanding of simple machines used in the construction.	A minority of group members can identify simple machines in their design and articulate the mechanical advantage of their construction. Explanations by several members of the group do not illustrate much understanding of simple machines used in the construction.
Construction - Materials	Appropriate materials were selected and creatively modified in ways that made them even better.	Appropriate materials were selected and there was an attempt at creative modification to make them even better.	Appropriate materials were selected.	Inappropriate materials were selected and contributed to a product that performed poorly.

Inquiry Lesson: Stream Table Exploration (Day 2)

Stream tables are effective tools to use in the classroom to allow students to explore and observe the development of a river system. I have found that attempting the design challenge without first giving students time to explore some sort of stream table activity, takes away from the effectiveness of the design challenge as students first struggle with how a rivers actually works.

Materials: A list of materials will depend on what type of stream table you have available or choose to work with.

Generally speaking you will need for each group:

- **A river bed platform:** Each group will need a platform on which to build their river model. The platform will need sides and have an outlet for water to escape. Any elongated plastic or metal container that you can cut a hole in for the outlet will work. A single aluminum roasting pan works fine, although splicing two together to create a longer stream bed would create a better effect. Stream tables work very well, but they are expensive. Plastic tubs or dishpans also work and have the benefit of being more stable. Bussing trays available from restaurant supply stores also work very well.
- **Earth:** Sand, wet diatomaceous earth, kitty litter, potting soil, pebbles, gravel, small rocks,
- **Tubing with some sort of clamping system:** a way for the water to slowly get in and a way for the water exit the tray
- **Buckets and pitchers:** water containers for both inflow and outflow
- **Student lab sheet or instructions.** One is provided here, but there are many available – again depending on what type of table you use.

Facilitators' Questions

The purpose of this activity is to allow students to observe and discover the changes in a river system over time, but as with all inquiry learning students will need your guidance to do so. As students observe their stream tables in action you can facilitate their learning with questions designed to help them focus on the changes.

Here are some possible questions to be used during the activity:

- What are some changes you are noticing at the beginning (middle, end) of your river?
- Has the shape of your river changed? Are there any curves that weren't there before?
- What are some possible reasons for those curves happening? (Try not to ask Why the changes are happening – that implies that they should know the correct answer and will shut most kids' thinking down)
- What is happening to the sediment? Where is it going? What does it remind you of? (This is in reference to the fan-shaped delta, which should start forming at the mouth of the river – be sure that the outlet continues to be open and flow) Try to get them to see the fingers or fan or triangle shape that develops.
- What is happening to the sides of the river channel? Is it getting deeper or wider?

When students are creating their own investigations you can help spur their thinking with questions that will help them brainstorm ideas to change in their system.

Possible changes include:

- Rate of flow of the water: What do you think will happen if we change how fast the water flows? How could we change that flow?
- Stream table height: Are all rivers flat? Are there differences in rivers that run down mountains from those that are on level ground?

Teacher Notes:

There are many sources to find information on stream tables. Most Earth Science textbooks have stream erosion investigations and give ideas on how to set up stream tables in your classroom. Carolina Biological Supply sells streams tables made by Hubbard Scientific. <http://www.carolina.com>

The GEMS Guide River Cutters published by Lawrence Hall of Science is an excellent resource for stream table investigations. <http://www.lhs.berkeley.edu/gems>

Please note:

Diatomaceous earth should be purchased from a swimming pool supply store, not a garden center (There are two different kinds). Only adults should handle the dry earth and always wear a dust mask. Students should not be exposed to the dry earth – only earth that is pre moistened.



- Obstructions in the sediment (pebbles, sticks, hills in the sediment): What if something got in the way of the water?
- Different sediment: Do you think that all sediment would work the same?

Closure:

For discussion afterwards, have students discuss their observations and findings. You can use the same questions you used during the exploration to help facilitate the discussion. At this point you would want to bring out real pictures of river systems and discuss and label the different parts of the river and how they differ. Science textbooks, magazines, as well as the Internet would be excellent sources for the pictures. A picture of the Mississippi or Nile Delta regions would be very useful.

Design Challenge #2 Two Rivers Ran Through It (Days 3-7)

Farmers in ancient Mesopotamia faced many challenges. As a result they developed new technologies to control the water coming into their field. In this integrated, multi-day challenge, students will discover the problems the farmers faced and devise working models that will attempt to solve those unique problems.

Grade Level: 6th

Educational Outcomes:

1. Students will identify the 3 major obstacles to farming along the Tigris or Euphrates River: drought during growing season, flood during harvest season damaging crops and homes, and transportation of water to the fields during times of low water.
2. Students will design and build a working model that attempts to solve all three of these problems. Models will include a working river system, model farm and town.
3. Students will gain an understanding of how humans modify their environment.
4. Students will show their understanding of the problems faced by ancient farmers by writing a short expository essay that describes the problems and proposes possible solutions.

Estimated Time: 3 class sessions (50 minutes)

MATERIALS AND SET-UP

Each group will need a platform on which they build their river model. The platform will need to have sides and an outlet for water to escape. Any elongated plastic or metal container that you can cut a hole in for the outlet will work. A single aluminum roasting pan works fine, although splicing two together to create a longer stream bed would create a better effect. Stream tables work very well, but they are expensive. Plastic tubs or dishpans also work and have the benefit of being more stable. Bussing trays available from restaurant supply stores also work very well. Groups do not need to have the same type of platform. This can be part of their decision of what materials to use. But the longer the tray the better.

Other materials to have for the creation of their models:

- Sand, kitty litter, potting soil, pebbles, gravel, small rocks, wet diatomaceous earth
- Popsicle sticks, small pieces of scrap lumber, toothpicks
- clay
- plastic wrap (for lining stream beds)
- cardboard
- Legos or building blocks
- string
- Water jugs, buckets and containers to collect the water.
- Plastic drop cloths for their work areas.
- Plastic tubing available from pet stores that sell aquariums will be needed for the water drainage, although shouldn't be allowed in the actual model.

Students are allowed to bring other materials from home, although the simplicity and availability of materials to Ancient Mesopotamians should be stressed.

Tools: scissors, glue guns, small saws, awls, vises, miter boxes

Set Up:

Students should be organized into groups of no more than 4

Materials and Organization:

- **Tool Table:** include a sawing area and a gluing area
- **Resource/ Supplies Table:** All materials should be set out on a table that is easily accessible. Special consideration should be given to the sand or kitty litter and how it will be distributed to each group. Pre-bagging it in gallon plastic bags would greatly assist the distribution.
- **Student Work Area:** Ideally students would be able to work outside, where spills can be more easily cleaned up. Inside use plastic drop cloths under their work areas.

A. INTRODUCTORY ACTIVITY

Students read the information provided on the geography and climate of the Fertile Crescent (See student handout). They identify and clarify new vocabulary, connect what they are reading to the river experience (Day 2: Stream Table Exploration) and identify the problems that ancient farmers faced. They are presented with the challenge and discuss constraints and materials. Working in teams students begin to brainstorm possible solutions to each of the problems that they discover in the reading.

Taking on the role of an ancient civil engineer, students compose an essay that identifies the problems and proposes solutions. Included with this is a sketch or diagram of their proposed solution. These are delivered to the King/Queen of the City-State (teacher) for approval. (This can be individual or group work.)

B. TWO RIVERS RAN THROUGH IT

Scenario:

You are an ancient Mesopotamian farmer working with other farmers to develop agricultural lands in the southern lowlands. You must identify the problems and challenges that your community might face in developing this farmland along the mighty river. You also must be able to explain your ideas of how to overcome these problems to your community so that work can proceed smoothly.

Challenge

Create a working model of the river, fields, and town that shows how you can overcome all of the problems identified in your proposal.

Constraints

- The model must show river, fields and town and solve all of the problems.
- No research may be done on how the Mesopotamians (or any other civilization) conquered the problems. After all, they were developing these ideas for the first time - surely you can too*.
- Only simple machines may be used – the wheel has barely been developed after all. You may research simple machines to give yourself ideas of how they could be used.
- Wood is in scarce supply. It is very expensive because it has to be transported from far away, so its use should be limited**.
- Each group member must participate in the design, construction, and presentation of the models (participation will be evaluated with a rubric—see Handouts section).
- You will be allowed to test your model as you work***.

Design Challenge Testing and Demonstration:

Students must explain to the class the basic design features of their model and how they solved the problems. Starting with the planting/drought season, students should demonstrate how they store and transport water to the fields. They can add small amounts of water to demonstrate this. Next the Rain God/dess (teacher) brings forth the yearly flood. Hopefully the Gods will be kind.

Teacher note: Use your judgment of how much water to pour. While it would be fair to always add the same amount of water to each model – different materials and platforms will only be able to hold or withstand so much water. The flood will need to be a flood for that particular model. You can use anything that will give you a good steady flow, but that won't take a huge amount of time to add the water. A large water bottle or watering can with a long narrow spout would work best. You can discuss the polytheistic religious beliefs of early civilizations at this point. Remember the Gods can be cruel, but teachers should be kind.

Teacher Notes:

The three basic problems facing the farmers were drought during planting season, flood during harvest, and transportation of the water to the fields. As a result, farmers developed dams, dykes and floodwalls to protect from flooding. They developed systems of storage ponds and irrigation techniques using canals and gates. In addition they developed simple machines to help transport water to the fields. While this seems obvious to us, I have found that students growing up in the city really struggle with these concepts. By allowing them a chance to develop these ideas on their own in a creative, dynamic way using the design challenge model, students develop a much clearer understanding of agricultural technology and how revolutionary it was.

It is imperative that students not be allowed to look at pictures of farming in Mesopotamia or do research of any kind. After they develop their models and solutions you can discuss how their solutions compared to the Ancient Mesopotamians.

* Allowing research negates the design challenge process of using technology to solve a problem in as many varied ways as possible. Research turns this into a model building exercise, which, although useful, is not as exciting or stimulating as Design Challenge.

**You could give students a limited amount of precious materials (such as wood) but allow them the option of trading or bartering with other groups for materials.

***Students are allowed to test their designs and revise based on their results. They should be encouraged to test their designs with varying levels of flooding (not to just carefully pour or drip water in) The Rain God/dess can be cruel!

Reflection:

After the demonstrations and cleanup, students and instructor should decide which designs were successful and in what ways. Students should be given time to reflect on how they would change their designs.

Teaching Points to Guide Reflection Questions:

Students should be able to discuss the problems facing the Ancient Mesopotamian farmers and how their solutions attempted to solve those problems. They should take into account how a river behaves based on their explorations with the stream table.

Facilitator's Questions

- What are the three major problems you have to find solutions for?
- How does your design address the flood, drought, and transportation problems.
- What will happen if the flood has more water than what you are testing?
- In the river exploration we did first, there was a lot of sediment carried to the bottom of the river. Do you think that will cause a problem in any way?
- During a flood what will need protection?
- How are you planning on transporting water from the river to the field? What are some limitations of your plan?

C. EXPANSION OF DESIGN CHALLENGE CONCEPTS

Comparison of student models to Ancient Mesopotamian methods and modern farming methods

- Using available textbooks or tradebooks on Mesopotamia, students and teachers read and compare pictures of farming techniques with the student models.

Teaching Points for Activity or Demonstration

- Students create a Venn Diagram comparing their model to pictures or text of Mesopotamian farming techniques, as well as to modern farming techniques.
- Vocabulary development should include dykes, floodwalls, and irrigation,
- Concept development should include the idea that modern farmers still use many of these same ideas to help them control and modify their environment.

Facilitators' Questions

- How does your model compare with the picture of Mesopotamian farming techniques?
- How did ancient farmers solve the problem of (flooding, drought, transportation)?
- What do you think of the ingenuity of Ancient Mesopotamians?

D. EVALUATION: See attached Evaluation Rubric

Please note: I would not necessarily show the rubric to students before hand, because I would not want to influence their design process. A successful design would be one that attempts to solve the problems and one where all the group members know why they created the different features of their model. It could possibly not work but still be considered a successful model.

E. HANDOUTS

Student Handout #1: The Tigris and Euphrates Rivers

Student Handout #2: Two Rivers Ran Through It

Evaluation Rubric

F. INSTRUCTOR RESOURCES

Banks, James et al. [Ancient World: Adventures in Time and Place](#). McGraw-Hill School Division. New York; 2000. Chapter 5, Lesson 1.

Bayley, Rosalind. [Mesopotamia](#). Librairie du Liban. Beirut, Lebanon; 1991



Hubbard Scientific: Stream Table Instruction Guide PO BOX 760 Chippewa Falls, WI 54729

"Mesopotamia". Kids Discover Magazine PO Box 54206 Boulder, Colorado 80323

Zeman, Ludmilla. Gilgamesh, Revenge of Ishtar and The Last Quest of Gilgamesh. Tundra Books, 1993.

Gems Teacher Guides. River Cutters. Lawrence Hall of Science, 1999 revised. (510) 642-7771
<http://www.lhs.berkeley.edu/gems>

Brainpop: Simple Machines
<http://www.brainpop.com/tech/simplemachines/>

Thinkquest: Simple Machines
<http://library.thinkquest.org/J002079F/sub3.htm>

Townsville Primary School: Simple Machines
<http://www.smartown.com/sp2000/machines2000/>

"InQuiry Almanack": Simple Machines
<http://sln.fi.edu/ga97/spotlight3/spotlight3.html>

Student handout # 1

The Tigris and Euphrates Rivers

The Tigris and Euphrates Rivers run through the region of land that became known as Mesopotamia. Mesopotamia actually means "land between two rivers" in Greek. The rivers begin in the Taurus Mountains in the north and flow down canyons to a vast rocky flatland or plateau. The rivers continue south across lowlands to the Persian Gulf. The rivers provide the southern lowlands with water and rich, fertile silt making them perfect for farming. Well, almost.

Due to the climate of the region the rivers receive little rainfall during most of the year. This means that farmers have to deal with drought conditions. The other part of the year the heavy rains produce huge floods that cause great damage to homes and crops, and loss of life.

To make matters worse, the drought condition happens in the early planting season when seedlings need extra water. The yearly floods occur during harvest time, when extra water can ruin the crops. Farmers have had to create new technologies to protect their fields from both drought and flood.

In ancient times, as farms produced surplus food, cities grew along the banks of the rivers. Larger farms were needed to provide food for the cities. Better methods of transporting water to the fields had to be developed.

Student handout # 2

Two Rivers Ran Through It

Scenario:

You are an ancient Mesopotamian farmer working with other farmers to develop agricultural lands in the southern lowlands. You must identify the problems and challenges that your community might face in developing this farmland along the one of the mighty rivers. You also must be able to explain your ideas of how to overcome these problems to your community so that work can proceed smoothly.

Pre Challenge:

Write a proposal that identifies the three major challenges and propose solutions. You may include drawings or diagrams in this written proposal.

The Challenge:

Create a working model of the river, fields, and town that shows how you can overcome all of the challenges identified in your proposal.

Constraints:

- The model must feature the river, fields and town and solve all of the challenges.
- No research may be done on how the Mesopotamians (or any other civilization) conquered the problems. After all, they were developing these ideas for the first time - surely you can too*.
- True to this time period only simple machines may be used (the wheel has only recently been developed). You may research simple machines to give yourself ideas of how they could be used.
- Use of wood should be limited**. Wood is in scarce supply and is very expensive and must be imported from great distances.
- Each group member must participate in the design, construction, and presentation of the models (participation will be evaluated with a rubric—see Handouts section).
- You will be allowed to test your model as you work.

Materials:

You will be provided one platform to build your working model. A variety of materials will be provided for you to build and create your model. Some materials such as wood will be limited, although you can trade with other groups. You may bring in materials from home, but they must be approved before you use them. You may use plastic to simulate clay or bricks, since we don't have time to make hand-made bricks.



Evaluation Rubric

Building A Structure: **Two Rivers Ran Through It**

Teacher name:

Student Name _____

CATEGORY	4	3	2	1
Construction - Care Taken	Creates a working river system that shows a river with head and mouth, city and farm. All placed in reasonable places.	Creates a working river system that shows a river with head and mouth, city and farm. May not be placed in reasonable places.	Creates a river but may not have an outlet. City and farm are included but may not be in reasonable places.	Creates a river with only a city or a farm not both.
Plan	Attempts to solve all three problems: drought, flood, and transportation of water to fields. Successfully protects both city and field from flooding.	Attempts to solve at least two of the problems: drought, flood, and transportation of water to fields. Successfully protects both city and field from flooding.	Attempts to solve at least one of the problems: drought, flood, and transportation of water to fields. Does not successfully protect both city and field from flooding.	Plan does not attempt to solve any of the problems. No protection from flooding.
Function	Structure functions extraordinarily well, holding up under atypical stresses.	Structure functions well, holding up under typical stresses.	Structure functions pretty well, but deteriorates under typical stresses.	Fatal flaws in function with complete failure under typical stresses.
Modification/Testing	Clear evidence of troubleshooting, testing, and refinements.	Some evidence of troubleshooting, testing and refinements.	Little evidence of troubleshooting, testing and refinements.	No evidence of troubleshooting, testing or refinement.
Scientific Knowledge	Explanations by all group members indicate a clear and accurate understanding of problems faced by early farmers underlying the construction and modifications.	Explanations by all group members indicate a relatively accurate understanding of problems faced by early farmers underlying the construction and modifications.	Explanations by most group members indicate relatively accurate understanding of problems faced by early farmers underlying the construction and modifications.	Explanations by several members of the group do not illustrate much understanding of problems faced by early farmers underlying the construction and modifications