

Teacher Resources: Lesson #1: Water as a Finite Resource

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Driving Question:

#1- Where does water come from and where does it go?

Learning Goal: Humans rely on water for a variety of uses, including personal use (drinking, washing, waste disposal), food production, manufacturing, and recreation. (4BM6-8 #8 p. 69; NSES 9-12F3a, p. 198). People from different cultures use different amounts of water. (NSES 9-12F3b, p. 198). The Earth is three-fourths water, but only a very small portion is fresh and useable by humans. (4BM6-8 #8 p. 68-69).

Objectives:

O1a - Recognize many of the ways that people use water in their everyday lives.

O1b - Recognize that people from different cultures use water differently (amounts and use).

O2 - Recognize that the amount of useable freshwater on Earth is minimal and finite.

Assessment:

A1 – Determine how much water you use.

A2 - Compare stories of how much water people in different cultures use.

Lesson Purpose:

In this lesson students will discover their own uses for water and compare that to the uses of others. They will read stories of individuals from different cultures in order to assess how others use water and recognize that water is not always a renewable or easily attainable source for everyone. Graphs of the amount of salt and freshwater will be used in order to recognize how little useable water there is on Earth despite the fact that 75% of the Earth's surface is covered by water.

Lesson Overview:

Activity Number	Label	Function	Description
1.1	Daily Journal questions	Elicit ideas; assess student's thinking	Students respond in journals to daily questions.
1.2	Calculate your personal water use	Engage; motivate This activity will engage students by incorporating their personal use of water, creating a realization of the importance of water in students' lives.	Students will use a water use table to calculate how much water they use in a week.
1.3	Comparing your water use with other cultures	Construct understanding This activity will establish an awareness of how water is used in other cultures and that water is not an endless commodity in all places.	Students will read stories of water use in other countries and compare them to their own use.
1.4	The Earth's water	Construct understanding; establish a problem This activity will instruct students about the amount of water on Earth and the amount that is useable for human consumption.	Students will analyze and interpret graphs to determine the amount of useable water on Earth and then apply this to sections 1.2 and 1.3.

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Activity Number	Label	Function	Description
1.5	Putting it together	Assess ideas This activity will be used to synthesize all previous ideas in an attempt to gain a full understanding of the importance of water as a resource.	Students will answer questions in order to put together all the information presented in the first four sections.

Preconceptions:

1. Students will most likely be surprised at the amount of water they use, however, they may not see this as a potential problem.
2. Students (especially in MI) will believe that water is easy to get and will never run out.
3. Students may think that water will never run out because so much of the Earth is covered with water. They will not realize how little is accessible and in a form that is useful to humans and other land animals.

Common Preconceptions	Goal Conception	Addressing activities	What to Emphasize
1- Personal water use	People from different cultures use different amounts of water. Compared to other cultures, most Americans use large amounts of water daily.	1.2 – Calculate your personal water use	Students will calculate the amount of water they use in a week.
		1.3 – Comparing your water use with other cultures	Students will compare their water use to that of the cultures depicted in the stories.
2 – Water is an infinite resource	Clean water is a valuable and limited resource.	1.3- Comparing your water use with other cultures	Students will read the story of Joseph who is dealing with a water shortage.
		1.4- The Earth's water	Students will interpret graphs of the amount of useable water on Earth.
3 – accessible water	The Earth is three-fourths water, but only a very small portion is fresh and useable by humans	1.4 – The Earth's water	Students will interpret graphs of the amount of useable water on Earth.

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Materials:

Activity Number	Per Student	Per Group	Per Class
1.1	Daily journal		Journal questions posted on OHP or board.
1.2	Student pages 1 and 2 Calculators (optional)		
1.3	Student pages 3 and 4		
1.4	Student pages 5 and 6		Overhead of Graphs
1.5	Student page 7		

Activity 1.1: Daily Journal Questions (10 minutes)

Function/Rationale:

This activity:

- 1) Allows the teacher time to take roll and complete administrative duties while students enter the room. Students should be expected to complete the journal activity everyday without prompting.
- 2) Elicits student ideas and previews the new lesson for the day.

Directions:

- 1) Post journal questions on the overhead projector or chalk board. Suggested journal questions:
 - a) Make a list of all the things you use water for in a day or in your life.
 - b) Do you think people on Earth use a lot of water?
 - c) Will useable water ever run out?
- 2) Students should respond individually in their journals to the daily journal questions.
- 3) Review the questions. Lead a short discussion asking for sample student responses.

Activity 1.2: Calculate Your Personal Water Use (20-30 minutes)

Function/Rationale:

This activity:

- 1) Engages students by incorporating elements of their real lives in the lesson.
- 2) Allows students to become aware of their personal water use.

Directions:

- 1) Go over the directions for the chart with the class. Remind students to consider all the times they do each item (example: Students wash their hands more than once a day). Some of the items are specific to certain seasons; you could have students assume it is summer or estimate how many times they would wash the car for example and average it into the estimate.

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From Student pages:

- 2) Have students answer the questions on the student pages after completing the chart.
- 3) Discuss the results with the class. Use the following additional questions to help lead the discussion.
 - a) Have students report their water use amounts. If you choose, students could record their usage on the board.
 - b) Were you surprised at the amount of water you use? Do you think it is excessive or necessary?
 - c) What are some ways you thought of to conserve the water?

Discussion Suggestions:

The purpose of this discussion is to elicit all students' ideas about water use and conservation. This discussion should be a place where students have an open voice and can learn from each other. Below are some suggestions that may help to facilitate this discussion.

- a) Draw out comments from all students; do not allow one or two students to dominate the discussion.
- b) Remind students that the questions posed in this discussion are open-ended and do not have a right or wrong answer.

Activity 1.3: Comparing Your Water Use with Other Cultures (20- 30 minutes)

Function/Rationale:

This activity:

- 1) Will begin to establish awareness of how others use water and that water is not necessarily an abundant resource.

Directions:

- 1) Pass out the stories of Sabiha and Joseph to the students; allow them to read these stories silently or aloud in the class.
- 2) After reading the stories, students will determine similarities and differences between each of the stories and their own water use.
 - The response is set up as a chart in which students must identify the individual in the group (with initials) that suggested each idea.
 - The initials are included so that each student in the group will have to contribute an idea. The chart should not be dominated by one individual -- everyone needs to participate.

From Student pages:

	Similarities	Group member initials	Differences	Group member initials
Sabiha and Joseph				
Sabiha and you				
Joseph and You				

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Activity 1.4: The Earth's Water (20 minutes)

Function/Rationale:

This activity:

- 1) Will allow students to work with real data to determine the abundance of available water on Earth.
- 2) Will continue to establish awareness of the availability of water as a resource.

Directions: This activity can be used in two different ways:

Option 1:

- 1) Use the worksheets for activity 1.4.
- 2) In this activity students will have to synthesize individual responses into a collective group response. Students may be more successful in completing this activity with a teacher guided example.
 - a) Use the analogy of a newspaper headline. Have students give ideas about the most memorable moments in a football game or other such event that they all would have experience with.
 - b) Engage in a discussion as how to put the ideas together to create one collective idea. If the class were to write a newspaper article about the event, what would the headline be? This is one way of synthesizing the ideas. However, in the assignment their answers will need to be more elaborate than a headline. They must fully explain the idea.
 - c) Explain to the students that this same technique will be used in their groups to accomplish the task. Remind students that the individual response and group response should not be identical; the group response should be an improvement or synthesis of all individual responses.
- 3) Students will work on answering the questions to this activity individually and as a group. Note the hints for checking student work below:
 - a) Students must first try to generate a response of their own and then they will discuss the response with the group to create a whole group response. Individual responses and group responses should not be identical.
 - b) The group response could be an improvement of the individual response; evidence of collaboration should be apparent.

Examples from student pages:

Your explanation		Group explanation	
Portions	Can be used for human consumption (yes or no)	Your explanation	Group explanation
Ice caps and glaciers			
soil moisture and very deep under-ground water			
surface water (lakes and rivers) and shallow ground water			

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Option 2:

Directions:

- 1) Use the following overhead of the graphs to facilitate a discussion with the students. Use the questions from the worksheet and these additional suggestions for this discussion. See Overhead on page 8 of teacher resources.
 - a) What is graph 1 saying about the amount of fresh and salt water? *Freshwater is only a small portion (3%) of all the water on Earth.*
 - b) In graph 2 are all the sources of freshwater available for human consumption? *No, only the surface, lake, river, and groundwater section is available to humans. The other portions are inaccessible or expensive to make available.*
 - c) What could the amount of available water mean for human water use? *Of the very small amount of freshwater on earth only a small portion of that is useable (less than 1%). Therefore, water is not as accessible to everyone as it may seem to some Americans.*
 - d) How can this information help us to understand the stories of Sabiha and Joseph better?

Discussion suggestions:

- 1) See suggestions in activity 1.2 for extra ideas.
- 2) These questions are not as open-ended as those in 1.2 and are meant for constructing understanding. Students should learn that although much of the earth is water, the amount of useable water is limited and as a result water is not an unending resource.

Activity 1.5: Putting It Together (15 minutes)

Function/Rationale:

This activity:

- 1) Will attempt to bring together the ideas from the previous activities.
- 2) Will assess how students' thoughts have changed concerning water use and availability.

Directions:

- 1) Pass out the question sheet to the students. Allow about 5 minutes for students to write a response to the questions. This will allow students time to put their thoughts together, which will help to facilitate a conversation.
- 2) Engage in a teacher-led discussion. Ask students about their response to the questions. Below are some questions to ask for question 1:

From student pages:

- | |
|--|
| 1. Look back at your personal water use -- what can you do to help conserve water? Assume that Sabiha and Nafia bring home about 50 gallons of water per day; could you limit your water consumption to this amount? Should you? Explain your answers. |
|--|

- a) What other types of problems or concerns might Sabiha and Nafia have about their water?
- b) How much could we limit our water consumption, but still enjoy our way of life?

Below are some questions to ask for question 2:

From student pages:

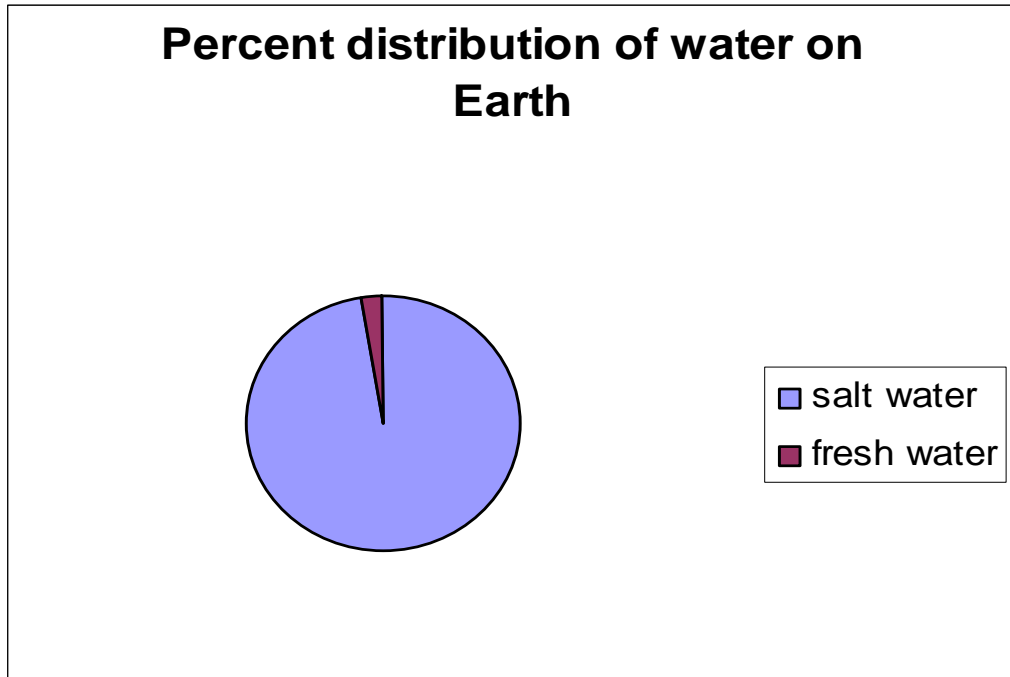
- | |
|--|
| 2. Thinking about what you learned about your water use, the water use of other cultures, and the amount of water available on Earth. Do you think there is enough water? How have your ideas changed from the journal question at the beginning of the lesson? Explain your answer. |
|--|

- a) Review ideas in activity 1.4: How much water is really available to humans? Where does this water come from? Why isn't all the fresh water available?

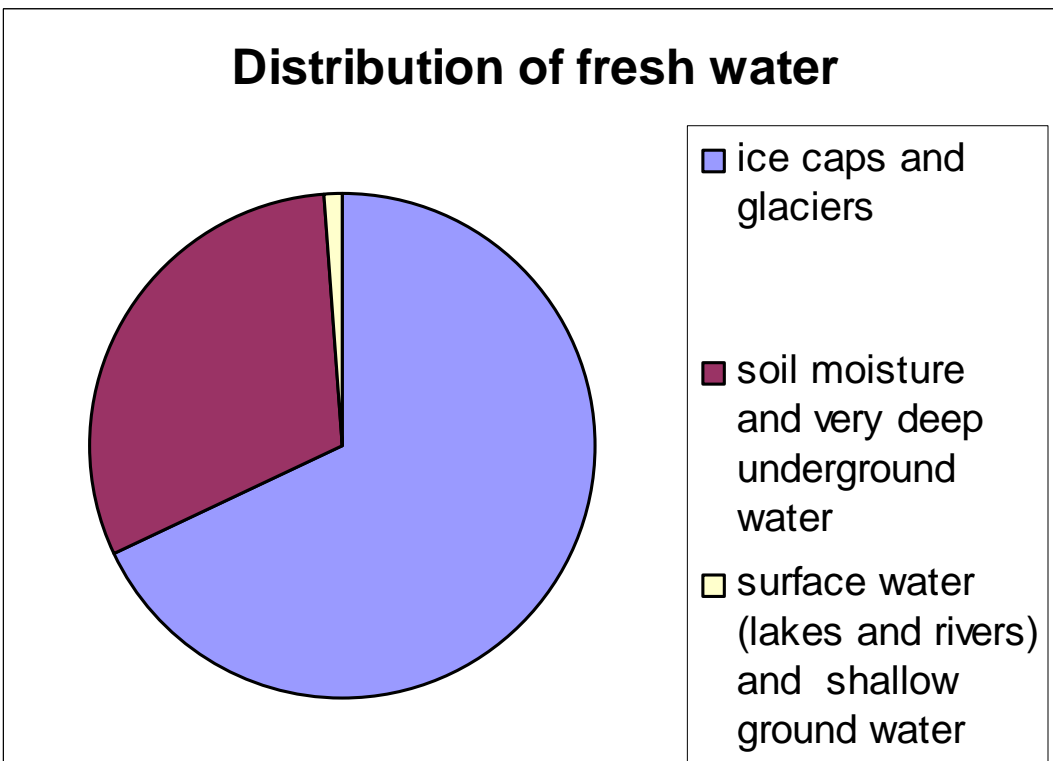
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- b) Think about Joseph: Do you think the water problem in New Mexico is permanent? Is this a new problem? A discussion of the abundance of water in the West vs. in Michigan could be used here.

Graph 1



Graph 2



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Activity 1.2

Calculate Your Personal Water Use

Purpose: In this activity you will figure out how much water you use. The activity is designed to increase your awareness of the exact amount of water you use and what you use it for. You can use this information to begin to think about how you can conserve water in your everyday life.

Directions: Do this part on your own.

1. Fill out the chart on the back of this sheet. Put in how many times you do each of the items listed. For example, if you wash your hands and face 5 times everyday, put a five in the box under each day. In the case of the shower put in how many minutes you spend in the shower each day. Remember to include if you take more than one shower.
2. Add up the times you did each activity to get your total for the week. For the hand and face washing example above the total would be 35.
3. For each activity, multiple the total number of times by the number of gallons and put this number in the total weekly use column.
4. Add up all your weekly gallons for the total number of gallons you used in a day.
5. Answer the questions below.

Questions:

1. How many gallons of water do you use in one week? _____
2. Figure out the average number of gallons used in one day. To do this, take the number in question one and divide by 7. _____
3. What things do you do that use the most amount of water?

4. What would or could you eliminate in your water use if water was limited?

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Name: _____ Hour: _____

Personal Water Use Chart											
Activity	Sun	Mon	Tues	Wed	Thurs	Fri	Sat	Total Number of Times	Estimated Amount of Water Used (gallons)	Total Weekly Water Use (gallons)	
Washing face or hands									0.50		
Taking a shower (standard shower head) number of minutes									6 per minute		
Taking a shower (low flow shower head)									2 per minute		
Taking a bath									40		
Brushing teeth (water running)									2		
Brushing teeth (water turned off)									0.25		
Flushing the toilet (standard flow toilet)									5		
Flushing the toilet (low flow toilet)									1.5		
Shaving									2		
Getting a drink									0.25		
Cooking a meal									3		
Washing dishes by hand									10		
Running a dishwasher									15		
Doing a load of laundry									30		
Watering lawn									300		
Washing car									50		

Name: _____ Hour: _____

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Activity 1.3

Comparing Your Water Use with Other Cultures

Purpose: Do you use a lot or a little water? You might be surprised how your water use compares to the water use of others around the country and around the world.

Directions: Answer these questions with your group.

1. Read the stories about Sabiha and Joseph. Think about how their use of water is different from yours.
2. Answer the question below with your group members.

Question:

1. Discuss with your group some of the similarities and differences between Sabiha's, Joseph's, and your water use. It is important that everyone in the group contributes. Put the initials of the person who suggested the answer written. Use the chart below to help you.

	Similarities	Group member initials	Differences	Group member initials
Sabiha and Joseph				
Sabiha and you				
Joseph and You				

Name: _____ Hour: _____

Comparing Your Water Use with Other Cultures - Stories

Sabiha, Africa

“Sabiha, go get the water, take your sister to help!” Sabiha knew the water buckets were low, but her mother always felt it necessary to remind her. It wasn't that she hated to get the water, for she knew how important it was to her family, but it was such a hard job. Sabiha is 15 years old. She has one sister, Nafia, who is 14. They live in a rural area in Kenya.

Sabiha and Nafia each grab three buckets for the water. It takes them about ten minutes to walk to the river where they will get the water. As they walk, they always talk about the pictures they saw in school of the pretty homes of the wealthy people in the city. They wonder what it would be like to have water come right to your house. They reach the river and greet a friend from school who is washing clothes and meal dishes with her mother. Sabiha sighs at the realization that she will be returning later in the day to do the same chores. Nafia instantly understands her sister's disappointment, so she quickly reminds her that they can swim and bathe after the chores are finished. Sabiha smiles at her sister; her sister always knows how to cheer her up.

Each girl carries the heavy buckets back to their home, two buckets in one hand and the other on their head. Upon arrival to the house the family uses about a gallon of the water to wash up before the morning meal. The majority of the water will be used for consumption and making food. After breakfast Sabiha asks her mother if she and Nafia can go swimming in the river. Their mother agrees on one condition: they must wash the dishes and some clothes while there.

Joseph, New Mexico

Joseph stepped off the porch and looked around the dry mountainous landscape, watching the cattle graze. His grandfather taught him how to appreciate and respect the land and all the land has to offer. Joseph prides himself on his Navajo Indian traditions; living on an Indian reservation in New Mexico, he tries to use the teachings of his grandfather everyday. After a few minutes of daydreaming and looking at the beauty of the Earth around him, he hears his father calling for him. Joseph's main chore is to monitor the water level of the stock ponds where the cattle drink and the amount of grass for the cattle to graze. It is his job to alert his father when the cattle have eaten all the grass and must be moved to a new location. Today is special; he will get to drive the truck with his father to herd the cattle. He is excited by the responsibility his father has given him, but he is also sad, because this is the last cattle drive for his family.

A drought and the diminishing water supply are limiting the growth of new grass to replace what the cattle have eaten. Joseph has watched other families deal with this problem. The cattle do not get enough to eat and the families have had to sell their skinny cattle for a very low price and no profit. Once Joseph's cattle have eaten all the grass at this new location, there will be no other areas with enough food. His cattle will be sold as well. Joseph worries about what his family will do when their livelihood is gone.

As Joseph drives the truck to herd the cattle, he remembers several trips he took with his father to Albuquerque where he watched people watering their lawns, swimming in their pools, and washing their cars. He can't understand why in the middle of a drought so many people are wasting water. While the city folk swim in their pools, he worries that his family will not have enough money to survive. If only they could hear the teachings of his grandfather and learn to use the land and resources wisely so that everyone would have enough water.

Name: _____ Hour: _____

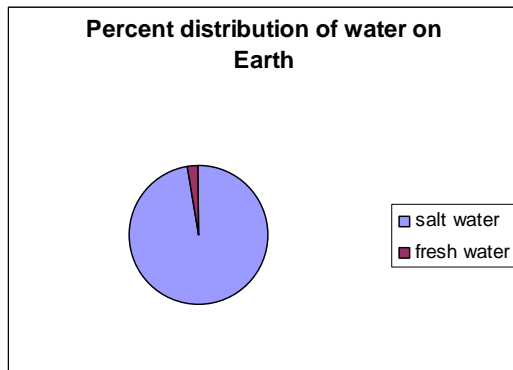
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Activity 1.4

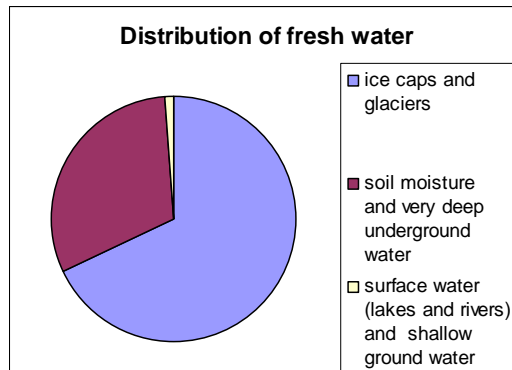
Purpose: How much fresh water is available on the Earth?

The Earth's Water

Graph 1



Graph 2



Directions:

Answer the questions below by yourself or with your group.

1. Explain in your own words what graph 1 is trying to say about fresh and salt water. Then discuss with your group their answers and put them together for a group answer. Your answer and the group answer should not be the same. The group answer should be a combination of all the best answers suggested.

Your explanation	Group explanation

2. Again answering in your own words then using your group's ideas to come up with a group response answer the following question: What do you think Graph 1 can tell you about water for human consumption?

Your explanation	Group explanation

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Name: _____ Hour: _____

3. Using graph 2, fill in the chart indicating which portions of freshwater on Earth can be used for human consumption. Explain why it can or can't be used in your own words then discuss with your group.

Portions	Can be used for human consumption (yes or no)	Your explanation	Group explanation
Ice caps and glaciers			
soil moisture and very deep underground water			
surface water (lakes and rivers) and shallow ground water			

