



Lesson Summary

Students gain appreciation for freshwater resources by comparing and contrasting water supply and quality in San Francisco and Kolkata (Calcutta), India.

Overview

In this lesson, students will:

- Read pen pal letters between students in San Francisco and Kolkata (Calcutta), India
- Compare similarities and differences with water supply, water quality and water access in both cities
- Fill out questionnaire on findings
- Do a comparative writing assignment

Background

We all need water to survive, yet one billion people on the planet do not have ready access to safe, clean drinking water. While many people living in developed countries are able to get high quality tap water on demand, many other people living in less developed countries do not have similar access to freshwater. Often their local water supplies are either dried up, or contaminated with microbes or chemicals that make drinking the water unsafe.

To celebrate World Environment Day* in 2008, an International Pen Pal Program partnered 4th grade students in San Francisco with students in Kolkata (Calcutta), India to discuss water in their city. These pen pal letters describe many similarities and striking differences between both cities' water supply. Kolkata gets much of its water from the Hooghly River, which eventually empties into the Bay of Bengal. The water in the Hooghly River originates in the Himalaya Mountains, but by the time it reaches Kolkata, it suffers from contamination due to regional industry effluents, air pollution and other contaminants. San Francisco gets its freshwater supply from the Hetch Hetchy Reservoir in Yosemite National Park. This water is pure snowmelt that originates in the Sierra Mountains, and is stored in the clean granite walls of the Hetch Hetchy reservoir, before traveling 167 miles downhill to be fed into San Francisco's water system. As such, San Francisco benefits from some of the highest quality drinking water found anywhere in the world. By understanding the differences in global water access and quality, students can expand their appreciation of local water resources while becoming more aware of other global citizens who equally deserve similar quality and access to this precious liquid.



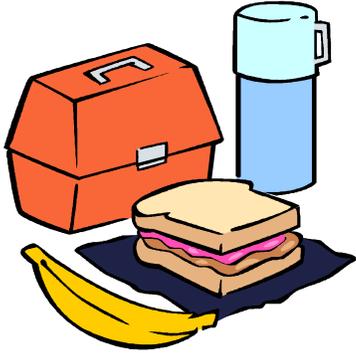
Time Needed for Lesson

75-90 minute class period
+ homework

Materials

- Pen Pal Letters (1 per student)
- Student Worksheet (1 per student)
- World Map or Globe
- 1 clear glass of water
- *What is Groundwater?* Fact Sheet and Comprehension Questions (optional)

* *World Environment Day was started by the United Nations in 1972, and is celebrated every year on June 5th.*



Preparation

1. Make all necessary copies.
2. (Optional) Distribute *What is Groundwater?* Fact Sheet and Comprehension Questions to each student. Have them read and answer questions as homework, or in class. Can also be done in small groups.

Pre-Activity Questions & Discussion

1. Gather students together as a class and ask the following:
2. What are three things all human beings need on the planet to survive no matter where they live? Write answers on board. (*air, water and food*) *Note: Shelter and clothing aren't required for survival in some parts of the world.*
3. Circle the word "water" and ask students to think of all things people use water for. Anything goes! Write answers on board. (*drinking, cooking, cleaning, washing, painting, ice skating, swimming, washing the dog, washing the car, fire-fighting, street cleaning, water balloon fights, running through the hose, watering the lawn and garden, growing food, making fake snow for skiing, decorative fountains, manufacturing things, etc.*)
4. Point to the list and ask students which things on the board are the least important uses for water. (*Answers will vary but will generally involve recreation such as water balloon fights, making fake snow, etc.*)
5. Point to the list and ask which things are the most important uses of water for people. Circle answers. (*drinking, cooking, growing food*)
6. Ask students how they get water at home for drinking and cooking. (*Some students may say they get their drinking water from plastic bottles. Most students should say that they get drinking and cooking water at home, straight from the tap.*) *Note: Drinking from plastic water bottles generates many problems including excessive waste and litter, over-consumption of petroleum resources, high cost, and unhealthy water that contains chemicals like Bisphenol A that are leached into the water from the plastic bottle. Therefore, there is now local, national and international effort to reduce consumption of plastic bottled water. While many students still drink out of plastic water bottles, it could be useful for students to identify other ways of getting water (like from the tap or public fountains) and for storing water (like using ceramic cups or metal bottles.)*
7. Pick up the glass of water and take a long sip. Tell students that this water is San Francisco tap water. Hold up glass and ask students where San Francisco gets its water supply. Point to Yosemite Valley on the world map when question is answered. (*Hetch Hetchy Reservoir in Yosemite National Park in the Sierra Mountain Range*)
8. Ask students to raise hands if they drink San Francisco tap water that comes from Hetch Hetchy, and to describe what the water tastes like. (*Unless the water is coming through old pipes, it should taste: clear, sweet, fresh, good.*) *Note: If possible, have kids sample SF tap water just before or during this lesson plan to provide a tasting experience.*

9. Point to different parts of the world on the map and ask students if they think other people around the world have access to the same quantity and quality of freshwater as we do in San Francisco. Take answers. (*Yes and No. It depends where people live. One billion people around the world do not have easy access to safe, clean, drinking water.*)
10. Ask students what they think are some reasons for this difference. (*economics, geography, infrastructure and technology, war, politics*)
11. Ask students if they consider themselves lucky to be living in this part of the world, where we have such a clean and ready supply of good quality drinking water, straight from the tap. Why or why not?



Classroom Activity

1. Tell students they are going to learn about water in another part of the world...Kolkata, India. (*Previously called Calcutta.*)
2. Call on a student to come to the front of the class, to find and point to Kolkata on the world map. (*Depending on the age of the map, student may have to look for the word "Calcutta."*)
3. Have student point to San Francisco at the same time and ask class how far away Kolkata seems to be from San Francisco. (*Approx. 7500 miles away-- just about on the other side of the world!*)
4. Ask students if they have any knowledge or pre-conceived ideas about the water in Kolkata, or India in general. (*Take answers.*)
5. Tell students they will learn about the water in Kolkata by reading some pen pal letters that were exchanged in 2008 in honor of World Environment Day. Explain these **real letters were actually written** between 4th grade students in Kolkata, India and 4th grade students in San Francisco, and that they will offer interesting information about the similarities and differences in our water supply.
6. Pass out Pen Pal Letters and Student Worksheet.
7. Have students read letters and fill out Worksheet. Letters can also be read out loud, back and forth as a class, in a group, or as homework. *Note: There are notable differences in the vocabulary used by the Indian students. Your students can use a dictionary to decipher words they don't understand, or discuss their meaning as a group.*



Follow-Up Discussion and Writing Activity

1. As a class, ask students to discuss some of the similarities and differences that San Francisco and Kolkata have in their local water supplies. Discuss access and quality such as:
ACCESS: San Francisco residents have access to indoor plumbing at all times--unless they are homeless, in which case they must depend on city faucets and public restrooms. Some Kolkata residents have access to indoor plumbing at all times. Other Kolkata residents who cannot afford it, do not have indoor plumbing where they live, or if they do, they have set times when the water flows, and they must store their water for use at other times. People in Kolkata who do not have indoor





plumbing must rely on city taps, wells and hand pumps for their water. **QUALITY:** San Francisco tap water is some of the cleanest and best tasting in the world. All San Francisco residents have access to this high quality water at all times. Kolkata tap water varies depending on the source it comes from; some of it is clean and relatively safe to drink, while some of it smells of chemicals and chlorine, or is brackish and salty. Not everyone in Kolkata has access to the better quality water, and many residents boil or filter their tap water before drinking it. Both cities suffer from water pollution from oil spills, chemicals and litter, though not always for the same reasons or to the same extent. **DROUGHT:** Both regions have experienced drought with significant consequences, although in Kolkata, people have to walk long distances to get fresh water from alternate wells if local wells dry up, and here in California, we don't have to do that since we still get water from indoor plumbing, even during times of drought.

2. Since some of the water in Kolkata comes from wells, it can taste salty or like it has chemicals in it. If students know about groundwater from reading the fact sheet, why might this water taste that way? *(Groundwater is very sensitive to contamination and seepage from above ground. There are factories in Kolkata that manufacture many things including pesticides, and some of these chemicals have probably entered wells by seeping into the groundwater supply below. Also, since one letter states that groundwater levels have dropped a lot in recent years, it's likely that saltwater intrusion has occurred, causing the salty taste in the water.)*
- 3 What is one service that San Francisco provides people to make it easier to prevent water pollution? Does this prevent all water pollution? Why or why not? *(San Francisco has a Hazardous Waste Collection Center where people can take all household hazardous waste like pesticides, motor oil and old house paint. This prevents water pollution by collecting waste that otherwise might be dumped down the drain or sent to the landfill where it could seep down and cause groundwater contamination. Since household hazardous waste is only one source of water pollution (in addition to other sources like litter, industry pollutants, oil spills, etc.) taking household hazardous waste to a collection center does not prevent water pollution from happening elsewhere, although it is a very effective way to reduce contamination.)*
4. What new thoughts and/or feelings do students have after reading the pen pal letters and learning about the similarities and differences in San Francisco and Kolkata's water supply? Do students have a greater appreciation for San Francisco water resources and quality? Will they change their behavior in any way regarding water use?

5. Ask students to pretend they are writing a final, comparative letter to the pen pal class in India. In this letter they will share the things they learned about what is similar and what is different between the water supply in San Francisco and Kolkata. Ask students to first write about the comparisons—those things which are similar, and then to write about the contrasts—those things which are different. This can be done as a homework assignment or in a small group setting.



Extensions

1. Ask students to do an artistic representation that compares and contrasts the two cities' water supply.
2. Have students ask older family members if they remember times of drought, and if so, what they did during that time to conserve water.
3. As a class, take the water bottle pledge which states:
In order to protect my health, take care of the environment, and save money, I pledge to:
 - Stop buying bottled water.
 - Drink tap water.
 - Use glass or stainless steel containers for water. *Note: Glass and unlined stainless steel containers are currently the safest way to carry water as they do not leach chemicals into the water. There is some concern about the safety of using polymer lined aluminum bottles as well as hard plastic bottles. Bottom line: the less chemical ingredients the water touches, the better.*
4. Have students design a Hazardous Waste Collection Center flier and distribute in the community and/or bring home to parents. Go to: <http://www.sfrecycling.com/sfhhw/facility.php?t=d>



CA State Standards

Grade 4 English Reading 1.1 (if students read aloud) • Comprehension and Analysis of Text 2.2, 2.3, 2.4 • Writing 1.4, 2.4 • Written and Oral English Language Convention 1.1 • Listening and Speaking 1.1, 1.2, 1.8

Grade 5 Reading 1.1 (if read aloud), 2.3, 2.4 • Science Earth Sciences 3e

Grade 6 Reading Comprehension 2.2, 2.3 • Writing 1.1, 1.2, 1.3
Written Conventions 1.1 • Word Analysis 1.1 (if read aloud), 1.4
Scientific Investigation and Experimentation 7d



CALIFORNIA



Pen Pal Letters



Water Here, Water There

Student Handout



Note: These are genuine pen pal letters. They were written in 2008 by 4th grade students.

Dear San Francisco Pen Pals,

We are very excited to be writing to you! We live in Kolkata, which used to be called Calcutta. It is in the State of West Bengal, in India. We are on the other side of the world in the continent of Asia. About 15,700,000 people live in our city. Kolkata is situated on the coast off the Bay of Bengal.

It is great living in Kolkata apart from the summers when the heat really becomes unbearable sometimes. It is very hot in our city now. We have our rainy season from June to September. That is when the monsoons come. It does not snow here and winters are pleasant. There are many types of trees here such as banyan, mango, coconut, neem and many, many others.

Our city is on the bank of River Hooghly that flows into the Bay of Bengal. The waters from the river come originally from the snow of Himalaya Mountains to the north of us.



Please tell us something about you and your city!

Your Kolkata Pen Pals

Dear Kolkata Pen Pals,

Thank you for your letter! We live in San Francisco, California in the United States of America, in North America. The population of our city is about 764,976.

San Francisco is a peninsula that is surrounded by water on three sides. We are located right next to the San Francisco Bay and the Pacific Ocean. The weather never gets too hot or too cold. Sometimes it is very foggy here and hard to see. It only rains in winter and the beginning of spring.

San Francisco gets its water from the Hetch Hetchy dam that was planned in the 1860s and was finished in 1934. The dam is filled by the Tuolumne River, which originates in the Sierra Mountains near Yosemite National Park. When the snow melts in the mountains, it fills the river and goes into the Hetch Hetchy dam where it is held. When the water gets released, it travels to our city in a large aqueduct, which is a series of pipes. Our water comes from 167 miles away and it uses gravity to travel downhill to get to us! This year we received little rain and we're worried that we would not have enough water.

Your San Francisco Pen Pals

Dear San Francisco Pen Pals,

Our water system was first put into force a couple centuries back by the British. The Hooghly River is the main source of water for our city. The river water is filtered and supplied from the age-old Palta Water Works that was first constructed in 1864. Other sources of water include wells that provide groundwater from aquifers.

Most of us have indoor plumbing and can get water when we turn on the faucet, but the less privileged may not be able to afford it. Some people in our city do not get water at all times of the day and therefore use stored water they get at fixed times. People who do not have indoor plumbing can get water from wells, or the municipality water taps and pumps.



Tap water in our city tastes different in different areas. That's because we have separate sources of water supply. This means the quality of water in our city varies from being safe to hazardous. Tap water tastes good and sweet in some areas. In others it smells and tastes of chlorine and chemicals. Sometimes it tastes salty and looks brackish. In some

areas there is contamination of ground water by factories that manufacture things including pesticides. Traces of arsenic and fluorides and wastes are found in our water too. Our groundwater levels have also dropped quite a lot in the last years.

In order to make our tap water safe for drinking, some of us boil it. Some others have filters at home. The best form of domestic drinking water storage in India is the earthen pots. Water remains cold in these pots and this is a technique of our ancestors that we still we practice.

Many of us in Kolkata also drink out of plastic bottles, but we are trying to lessen our use of these because they create a lot of problems such as waste and trash. Plus, we have learned that the chemicals used to make plastic, get into the water itself. Therefore, we are using glass or metal flasks to carry our water.

What is the tap water like in San Francisco?

Your Kolkata Pen Pals



Dear Kolkata Pen Pals,

In San Francisco, every house and apartment has indoor plumbing with running water. All office buildings, restaurants and public places have indoor plumbing

as well. Unfortunately there are some people who are less fortunate and do not have a home, such as the homeless, but they too can access water in other ways. Some ways people can get water outside of the home include catching rainwater, going to a shelter to get water, getting it from public drinking fountains, or buying water in plastic bottles.

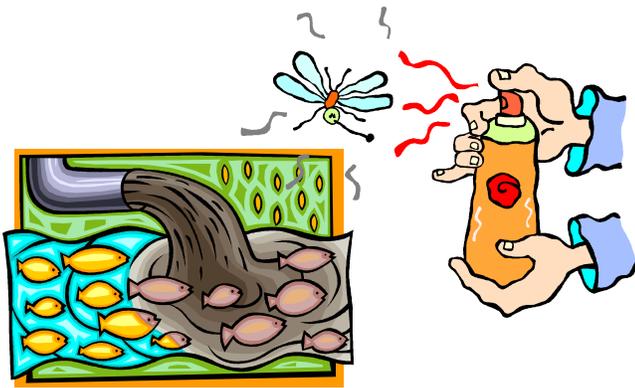


San Francisco has really good water quality, and it has no bad taste. Our water is safe to drink from the tap, although some people still like to filter it at home. We learned that our water is some of the cleanest in the country when our Mayor came to visit our school. Our water tastes fresh and clean. It is cool and refreshing. We too drink out of plastic bottles sometimes and are trying to use them less too. Some of us have metal bottles filled with San Francisco tap water. Drinking water out of the faucet is cheaper than buying plastic bottles, and is better for the environment.

We think that people generally are appreciative of the fresh water we have. However sometimes we don't realize how lucky we really are to have such fresh water so easily. We are wasteful of water when we let the water run when we do dishes, brush our teeth, or wash our hands or our cars. We are careful with water when we don't let the water run and tightly turn off the tap.

We look forward to hearing from you.

Your San Francisco Pen Pals



Dear San Francisco Pen Pals,

It sounds like you are lucky to have such an excellent supply of fresh water!

This week, we have been investigating certain facts about river Hooghly and factors that cause water pollution. Yes, pollution in the water system in Kolkata started a long time ago. It is caused by dumping of garbage, accidental oil spills, industrial waste, bathing, washing, and disposal of domestic waste. Another problem of river Hooghly is that we immerse idols in the river after worshipping them at ceremonies held from time to time. This is an important part of some of our religious festivals and the government is working on a plan so that idols can be disposed without polluting the river.

Sadly our city does not have a system for properly disposing hazardous waste. This is a big problem as toxic chemicals can seep into the groundwater below and cause our water supply to be polluted. We can help by using only eco friendly products and not using harsh chemicals for domestic cleaning and washing. We can use rat traps, and electric fly repellants in order to avoid using chemical sprays and pesticides that cause water pollution.

We hope that other people in our city will also stop using so many chemicals that end up damaging our water supply.

Your Kolkata Pen Pals

Dear Kolkata Pen Pals,

Your letter was very interesting. We learned a lot about some of the problems your city has with water pollution. The San Francisco Bay is somewhat polluted too. Last year there was an oil spill in the bay when a big boat crashed into the Bay Bridge. The oil coated the feathers of many seabirds and many of them died. We were very sad about that. Other kinds of pollution in our bay and ocean include plastic bags, six-pack can holders and diapers, and other trash, as well as oils that come from storm drains. This pollution hurts sea turtles, fish, local birds, and marine mammals like dolphins and otters. Recently our mayor banned plastic bags from being given away in big grocery stores. This has helped reduce the amount of plastic bags that fly around as trash and end up in our water hurting the marine life.

Other sources of water pollution include dangerous chemicals found in pesticides, drain cleaners, motor oil and other things like that. We have learned that instead of flushing hazardous waste down the toilet or sink, that people can take it to a Hazardous Waste Collection Center in the city. There, the waste products are taken care of so that they don't get into the water system.

Maybe one day Kolkata will get a Hazardous Waste Collection Center too! Does your city ever have droughts?

Your San Francisco Pen Pals

Dear San Francisco Pen Pals,

The districts neighbouring Kolkata faced a drought in the summer of 2001. Due to the drought, we had huge failure in farming because most farmers are dependent on rainwater for farming. There was acute shortage of fresh drinking water too. Ponds and wells dried up and people sometimes had to walk

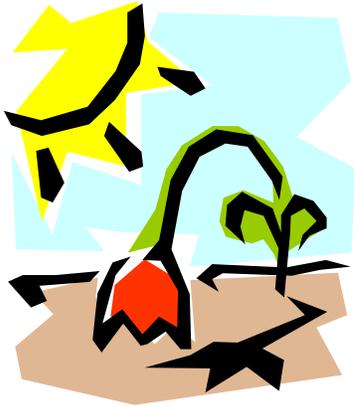
long distances to fetch fresh drinking water. Plants and trees withered and the land cracked up in many places thirsting for water.

We really appreciate our fresh water supply at most times. However we are at times perturbed when we carelessly let

water drip from domestic taps, cisterns, and public taps. Sometimes we indulge in long showers, but we will not do this any more! During a time of drought our class feels we should use fresh water only for drinking and cooking. Wherever possible we should recycle impure water for cleaning, etc. We will not collect or store fresh water unnecessarily, and will only use it to fulfill our bare minimum requirements. Plants around must be carefully tended to using water wisely.

We know and realize how lucky we are compared to many other people who face untold hardship to procure fresh water. So we always close taps after use and have decided to keep household effluents as harmless as possible while draining out. Most of us have realized and decided that the water we carry to school will be drunk by us fully before we fill it up with water from coolers at school. At home this summer we will try to bathe with limited water and try not to do so too many times.

Your Kolkata Pen Pals



Dear Kolkata Pen Pals,

We too have had droughts in our area, and are experiencing one now! We have not had a lot of rain the past two years and there is a drought throughout our state. Because of the drought, there are forest fires and high fire danger. Recently there were big forest fires in the Santa Cruz Mountains, about 60 miles south of San Francisco.

When there is a drought, people are supposed to use less water and are supposed to be very careful of fire danger. In order to conserve water, we are trying to take fewer and shorter showers and turn off the water when we're washing our hands and doing the dishes. We know that water is something we all need, no matter where we live.

We have enjoyed writing to you and hearing about your home and culture. We learned a lot of new things from you. It was interesting that a lot of problems you have with your water, we have a lot of the same problems, like pollution and trash. We can all help the environment by making better choices and learning about what are the best choices.



We also learned it's easy to talk to someone halfway around the world and that we are similar in many ways!

We hope to meet you sometime!
Your San Francisco Pen Pals



Compare (which things are similar?) and Contrast (which things are different?)



San Francisco and Kolkata share similarities and differences in their water supply. Read the Pen Pal Letters and answer the following questions so that you can compare and contrast water use in both cities. Use a separate sheet of paper and write in full sentences.

1. Compare and contrast the weather in San Francisco and Kolkata. Include temperature, rainfall, etc.
2. How do the main water supplies for San Francisco and Kolkata differ? What are they named? How near or far are they from the city?
3. Compare the mountains where water originates for both cities. What are they named?
4. How is tap water quality in San Francisco and Kolkata different?
5. Contrast what people in Kolkata do to their tap water at home before drinking it, with what people in San Francisco do.
6. Compare the use of plastic water bottles in both cities. What is similar?
7. Compare the sources of local water pollution in both cities (in the Hooghly River and the San Francisco Bay). Contrast how the water pollution affects the quality of the tap water in each city.
8. How does the ability to properly dispose of hazardous household waste differ between San Francisco and Kolkata ?
9. Compare and contrast the effects drought has had on both regions. When were the last droughts?
10. Do students in both cities appreciate their fresh water supply? Compare what students in San Francisco and Kolkata said they would do to help conserve their water.



1. Compare and contrast the weather in San Francisco and Kolkata. Include temperature, rainfall, etc.
It does not snow in either San Francisco or Kolkata. San Francisco gets fog and has its rainy season in the winter and spring. Kolkata has monsoons and their rainy season is from June to September. It also gets very hot in Kolkata but not that hot in San Francisco.
2. How do the main water supplies for San Francisco and Kolkata differ? What are they named?
How near or far are they from the city?
The Hetch Hetchy Dam provides water for San Francisco and is 167 miles away. The Hooghly River provides water for Kolkata and the city is right on the riverbank.
3. Compare the mountains where water originates for both cities. What are they named?
For both cities, the water comes from snow that originates in the mountains. For San Francisco, it originates in the Sierra Nevada Mountains and for Kolkata it originates in the Himalaya Mountains.
4. How is tap water quality in San Francisco and Kolkata different?
San Francisco has some of the highest quality drinking water in the world that tastes fresh and clean. Kolkata has some good drinking water and some hazardous drinking water, depending on the source. Some of Kolkata's water smells and tastes of chlorine and other chemicals like pesticides. It can also be salty or brackish. Some of the water is also contaminated with arsenic, fluorides, and waste.
5. Contrast what people in Kolkata do to their tap water at home before drinking it, with what people in SF do.
In Kolkata, people boil or filter their water to make it safe to drink. In San Francisco, nothing needs to be done to tap water before drinking it, although some people do filter it as well.
6. Compare the use of plastic water bottles in both cities. What is similar?
People in both cities use plastic water bottles but are trying to reduce their use of plastic bottles by carrying water in metal bottles or flasks instead. The problems with plastic water bottles are that they create waste, are expensive, and actually contain chemicals that can get into the water itself.
7. Compare the sources of local water pollution in both cities (in the Hooghly River and the San Francisco Bay). Contrast how the water pollution affects the quality of the tap water in each city.
Both cities have local water pollution that comes from trash, oil spills and other chemical pollutants. Since San Francisco does not get its water from the San Francisco Bay, its drinking water is not affected by this pollution. Kolkata on the other hand drinks from the Hooghly River, so pollution in the river affects their drinking supply.
8. How does the ability to properly dispose of hazardous household waste differ between SF and Kolkata?
San Francisco citizens can take all hazardous household waste to a local Hazardous Waste Collection Center. Citizens in Kolkata do not have a Hazardous Waste Collection Center.
9. Compare and contrast the effects drought has had on both regions. When were the last droughts?
In the Kolkata region, there was a drought in 2001. It caused a huge failure in farming, because most farmers depend on rainwater for farming. There was also a shortage of drinking water. Ponds and wells dried up and people had to walk long distances to fetch fresh drinking water. Plants and trees withered and the land cracked. As of 2013, San Francisco's last drought was 2008-2011. During that time there were many destructive forest fires. In both cities, students realize that water must be saved.
10. Do students in both cities appreciate their fresh water supply? Compare what students in San Francisco and Kolkata said they would do to help conserve their water.
Students in both cities definitely appreciate their fresh water supply. They both said they would take shorter showers and not let the tap run when washing hands or doing dishes. Students in Kolkata said they would prioritize water use for drinking and cooking and would recycle impure water for cleaning, etc. They also said they would water houseplants wisely.

