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Project Summary and Developmental Programs for ISHEW

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Introduction

On a seemingly normal day during my study abroad in Ghana, we noticed that the sun was shining in a sky that seemed to have no clouds. We were taking a trip to visit the water source of a community that contained nearly 1,000 people. Although it amazed us to think that that many people were fetching water each day from a river, we understood that others do not have access to the purified, city water that we are fortunate to have at home. When we pulled into the community, the reality of their lifestyle contrasted with what we had imagined. We saw a small city full of stone, cement, and brick buildings that went back as far as we could see. Between the cars zooming past on the road, we noticed people walking along the road using cell phones. As we walked toward the riverbank, we saw two young women leaving the area carrying large buckets of water on their heads. We were told that this was the singular location that the entire community fetches water from. As we approached the river, we noticed two teenage boys joyously fishing. They were happily catching catfish next to another child who was quietly bathing himself. Within the same 30 feet of riverbank, a strong woman was lifting the largest bowl we had ever seen on to her head. As she lifted the bowl full of water, the two boys who were fishing ran over to help her lift it. The realization that this community was in dire need of a clean water source came when we joined these individuals at the waterside and took a brownish-yellow, turbid water sample from an area not far from where the strong woman had just collected her own.

We had a similar experience when collecting samples from a coastal community whose water came from stagnant pools of freshwater. We collected a yellow sample with visible debris from the water where we watched children playing games, a child bathing, and another child gathering water. This story is common throughout the smaller communities within Ghana, as well as many other developing nations. During our study abroad in Ghana, we visited several communities and villages where we observed many health and sanitation issues that reflected their dire necessity for clean water and better health practices.

These were just a few of the many life changing experiences we encountered during our summer on the Ghana Honors Service Learning Study Abroad trip for 2016. This trip allowed for students to work closely with one of three organizations: Ghana Health Service, Challenging Heights, or International Sustainability Health Education and Water (ISHEW). Though a class is taken during the time in Ghana, the focus of this study abroad is for students to actively perform service projects from which they learn and benefit as much as the constituents that they serve. The purpose of our report is to describe our time working with ISHEW and some of our projects, as well as some of the needs of the non-governmental organization (NGO). ISHEW's focus is on equitable development and sustainable solutions for communities within Ghana in regards to health, education, and water. They believe that these three aspects are directly tied to a community's vulnerability to poverty and human trafficking, which continue to be major problems throughout Ghana. We will report the results of water testing done during our time with ISHEW in Ghana and describe a locally produced biosand filter that we created. We will then describe the needs of the developing ISHEW water testing lab and explain our projects creating first-aid kits and a hand-washing station. Finally, we have developed a health educational curriculum for future study abroad students to teach to primary schools while they work with ISHEW.

Water Testing Results

There are numerous ways that we observed people in Ghana collecting water from freshwater sources, though the most common were fetching from a river or a stagnant body of water source. One community had a natural method for collecting rainwater that fell onto a large rock. Drinking water directly from these traditional sources exposes people to a multitude of microbes that can cause health problems. Though there are many different ways to obtain clean water in these communities, the best method depends on each community and its characteristics. One common method in Ghana is the traditional well that may be open or closed, but ISHEW prefers to install biosand filters, boreholes, or hand-dug wells.

During our time in Ghana, we tested hand-dug wells, traditional open and closed wells, raw water sources, and the tap water purified and provided by the city of Winneba. Below is a table that outlines the results from these tests. The tests were performed using Aquagenx water testing kits that separates a sample into 5 different compartments. A color change from yellow to green in a compartment indicates contamination due to E. coli. See Table 1 on page 3 for results.

Though each case is different, all water samples taken of raw water ranged from possibly safe to very unsafe to drink based on 3 or more compartments turning green. The open well in Asemua Krom also resulted in 5 green compartments and was very unsafe to drink from. Sikafrebouja's closed well was also deemed very unsafe due to all 5 compartments turning green. We hypothesize that this result is due to closed well is pumped to the surface with no filtration system for the groundwater. The test from the closed well in Bonsukesi, however, had no green compartments and was deemed safe to drink. The hand dug-wells, which pump water through gravel and sand, in Twabidi and the Winneba North Campus ISHEW lab ranged from safe to drink to probably safe with 1 or fewer green compartments. The tap water that was tested had inconsistent results.

Based on these results, ISHEW would like to provide more hand-dug wells to communities in need where applicable because it ensures that there is some type of filtration system for the groundwater that is being pumped from the area.

Location	Source Type	Aquagenx Results	Safety Level	Additional Comments
Ntakofa River (Winneba North Campus)	Raw river water	5 green	Very unsafe	Brown color, visible debris
Winneba North Campus ISHEW Lab	Hand-dug well raw	3 green, 2 yellow	Intermediate risk, possibly safe	Yellow color , high iron, high salt
Winneba North Campus ISHEW Lab	Hand-dug well filtered	5 yellow	Safe to drink	
Winneba North Campus ISHEW Lab	Winneba Water Works filtered tap	2 green, 3 yellow	Intermediate risk, possibly safe	Clear
Winneba North Campus ISHEW Lab	Winneba Water Works filtered tap	5 yellow	Safe to drink	clear
Essuekyire River	Raw river water	4 green, 1 yellow	High risk, unsafe to drink	Brown color, visible debris. Advised to use hand-dug well
Warabeba	Raw water from stagnant body	5 green	Very unsafe	Very high salt, high iron, turbid
Sikafrebouja	Closed well	5 green	Very unsafe	Covered open well with no sand or rock filtration
Asemua Krom	Open well	5 green	Very unsafe	
Twabidi	Hand-dug well filtered	1 green, 4 yellow	Intermediate risk, probably safe	
Bonsukesi	Closed well	5 yellow	Safe to drink	

Table 1: Results from Aquagenx testing of various water sources during our time with ISHEW in Ghana.

Locally Produced Biosand Filter

During our first meeting with the leaders of ISHEW, we determined that one of our major goals for our time in Ghana was to create a locally produced biosand filter. Biosand filters allow for individual households or small communities to purify the water that they fetch from their usual water source. Biosand filters use a series of small stones, gravel, sand, and a biological layer of microbes to purify a water source. This type of filtration system removes most microbes, some sediment, and generally improves the taste and appearance of the water. Biosand filters effectively remove contaminating microbes from the water as they are consumed by microbes in the biolayer, or become trapped in the sand layer and die due to starvation or the mechanical trapping. These filters are estimated to maintain a lifespan of 10 to 30 years of use.

Currently, ISHEW purchases biosand filters from Cascade Engineering in the United States at cost of approximately $100 per filter. Though these filters are produced to last for 20 years, these filters are quite expensive to provide for larger communities or multiple families. ISHEW wants to use local materials to produce their own biosand filter. Having the ability to produce biosand filters locally in Winneba and throughout Ghana will make ISHEW's water projects much more sustainable. In addition, it keeps money in the economy, allows for repairs to be done within the country, and also offers users a level of comfort by being created with familiar products.

We spent a couple days looking for the appropriate materials to construct a local biosand filter. Because there were many shops with similar products at the markets, we spent our time shopping for the best quality supplies with the cheapest cost. We were able to find all of the supplies needed for the biosand filter and a plumber who was willing to connect all of the piping to the bucket. The price estimates are as follows:

- Bucket – GHc20
- Bowl for diffuser – GHc20
- Piping supplies – GHc50
- Labor fee for plumber – GHc10
- Sand, gravel, and stone – GHc7*

  Total cost estimate: GHc107*

  *This estimate is created assuming sand, gravel and stone are purchased in bulk, with one trailer costing approximately GHc 3,500. This will provide enough materials for a minimum of 500 filters.

Local production of a biosand filter will reduce the cost of production from $100 to less than $30 (at GHc 107 with the current exchange rate) when produced on a large scale. Though these locally produced filters are significantly cheaper, the initial cost will be greater for ISHEW as they will need to purchase the sand, gravel, and stones in bulk. The estimated cost to produce 500 filters locally is GHc 53,500, while 500 filters purchased from the US would cost approximately GHc 200,000.

While we were waiting for the bucket and piping to be assembled, we were able to obtain enough stones and gravel for a single filter at a small fee from the stone company. We collected, washed,

and dried fine sand from a riverbank nearby prior to use in the filter. We added the larger stones first, then the smaller gravel, and finally the sand, making sure to leave several inches above the sand to allow for a layer of standing water to form below the diffuser plate.

The filter will be tested for several months before it can be given to communities. We established the locally produced biosand filter at the ISHEW Water Testing Lab location and fetched water from a nearby river. Water was run through the filter every day for 2 weeks to allow for the biolayer to form. The results from these tests are depicted in the Table 2 on page 6. The initial flow rate of the biosand filter was relatively slow, as expected, but had increased within a couple days. Though the raw water sample maintained a constant level of contamination throughout the 20 days of sampling, the filtered samples became more pure. This suggests that a biolayer has developed and is effectively removing E. coli from the raw water. Future tests will determine if the biolayer remains after an extended period of time. Initial results are promising for the functionality of the locally produced biosand filter. Since the flow rate is now sufficient enough to support a few families, it can be considered a viable alternative to the more expensive biosand filter that is built in the United States.

References

Centre for Affordable Water and Sanitation Technology. (2011). *Filter Your Water – Biosand Filter*. Calgary AB, Canada: CAWST.

Centre for Affordable Water and Sanitation Technology. (2011, October, 10). *Fact Sheet: Biosand Filter*. Calgary AB, Canada: CAWST.

Day	Date		Raw Water	Filtered Water	Safety Level of Filtered Water
1	July	21	5 green	5 green	Very unsafe
2		22	5 green	5 green	Very unsafe
3		23	5 green	4 green, 1 yellow	High risk, unsafe to drink
4		24	5 green	4 green, 1 yellow	High risk, unsafe to drink
5		25	5 green	4 green, 1 yellow	High risk, unsafe to drink
6		26	5 green	3 green, 2 yellow	Intermediate risk, possibly safe
7		27	5 green	3 green, 2 yellow	Intermediate risk, possibly safe
8		28	5 green	3 green, 2 yellow	Intermediate risk, possibly safe
9		29	5 green	3 green, 2 yellow	Intermediate risk, possibly safe
10		30	5 green	3 green, 2 yellow	Intermediate risk, possibly safe
11		31	5 green	3 green, 2 yellow	Intermediate risk, possibly safe
12	August	1	5 green	2 green, 3 yellow	Intermediate risk, possibly safe
13		2	5 green	2 green, 3 yellow	Intermediate risk, possibly safe
14		3	5 green	1 green, 4 yellow	Intermediate risk, probably safe
15		4	5 green	1 green, 4 yellow	Intermediate risk, probably safe
16		5	5 green	1 green, 4 yellow	Intermediate risk, probably safe
17		6	5 green	1 green, 4 yellow	Intermediate risk, probably safe
18		7	5 green	1 green, 4 yellow	Intermediate risk, probably safe
19		8	5 green	1 green, 4 yellow	Intermediate risk, probably safe
20		9	5 green	5 yellow	Safe to drink

Table 2: Results of Aquagenx testing of the locally produced biosand filter for the first 20 days after being assembled.

ISHEW Water Testing Lab Development

Although one of ISHEW's main focuses is to provide clean water for communities, they do not have a space dedicated to the water testing. The NGO is in the process of building its own water testing laboratory at the same location as its main office, near Winneba North Campus. We hope to aid ISHEW by providing a full description of the supplies that they require to have a fully functioning water testing laboratory.

Current Needs:

- Gloves
- Laboratory notebooks
- Different colors of permanent markers (black, green, red, blue)
- Aquagenx kits
- Fuse and repair for Colilert tray sealing machine
- Laboratory coats
- Black/ blue pens
- Chlorine tablets/ Chlorine bleach
- Tissues/ Kim wipes
- Rack and chest to organize Aquagenx kits as they are incubating
- Thermometers
- Biohazard container

Currently, the ISHEW water testing laboratory have several Aquagenx and Colilert test kits. These kits are consumable and will need to be replaced as they are used. The Colilert kits require a machine to seal the trays closed after the sample has been added to them. The ISHEW laboratory has a sealing machine, but it needs repair and a new fuse. Both the Aquagenx and Colilert tests have advantages and should continue to be utilized by ISHEW.

General laboratory supplies are required by the ISHEW water testing lab, including laboratory coats, notebooks, gloves, pens and markers, tissues/Kimwipes and thermometers. Because of the test kits that ISHEW uses, they require chlorine bleach or chlorine tablets to sterilize samples before disposal. A biohazard container is needed to throw trash away before it can be sterilized. Lastly, as ISHEW expands its services and conducts more water testing, they need a way to organize their test kits. Ideally, a chest with a rack inside to organize the Aquagenx kits as they are incubating.

In the future, after the lab has established itself and hired a full time lab technician with a microbiological background, the lab can expand its research and do more testing. At this point, the laboratory will require better technologies, such as petri plates, different types of growth medium and stains, a PH meter, water bath, autoclave, microscope, and a computer.

First-aid Kit

The headmistress of the M/A Basic School in Atekyedo expressed that one of the largest challenges that their school faced in regards to health was the lack of a first-aid kit. The school had small bandages for minor scrapes, but needed to send injured children to the nearest community-based health planning and services (CHPS) center for treatment. The current system causes children to miss school due to being sent to the CHPS center when the injury could be treated at school. In addition, it increases the risk for children missing more school if injuries are left untreated and worsen or develop infections.

To address this problem, we spent a day assessing the costs of producing first-aid kits in Winneba. We were able to look at different medical supply stores to compare prices for the cost of first-aid kits. We purchased materials for two kits from AB Chemists Ltd and the Supply Store next door and the costs, per kit, are as follows:

- Gauze – GHc10
- Methylated Spirit (denatured alcohol) – GHc10
- Bandage – GHc15
- Plaster – GHc12
- Gentian Violet – GHc4
- Cotton – GHc15
- Lexosporin Powder – GHc14
- Container – GHc9

  Total Estimated Cost: GHc 89 (approximately $22)

One of the first-aid kits was donated to the M/A Basic School in Atekyedo where the headmistress expressed the need for it. We donated the second first-aid kit to the Non-Formal Education Division in Winneba. The classroom we donated it to at this school works to reintegrate children into the general education system, often after they worked as child laborers. Both classrooms were incredibly grateful for the donations and we encourage that this project continues for ISHEW in the future. We learned that small donation can make a grand impact on the health and education for students within a school in Ghana.

Handwashing Station

For part of our project, we explored ways to further the development of sanitation and proper hygiene among school-aged children. Through observing and assisting with health examinations conducted by the Ghana Health Service, it was evident that children were not properly washing their hands, if at all, based on the amount of dirt under their fingernails.

While visiting the M/A Basic School in Atekyedo with ISHEW, we were able to speak with the headmistress about what she felt the schoolchildren needed most. We were given permission to observe the classroom setting as well as walk around to view the washroom facilities. While viewing the washroom facilities, we were quick to realize that these children had no efficient way of washing their hands. We sat down with the headmistress again and she expressed that the children could benefit from having bowls to wash their hands in. We were skeptical of the fact that these bowls would then be a reservoir for dirty water in between the washing of hands, and there was no way for us to guarantee that the water held in these bowls would be clean for handwashing. We bid our farewells and started to think how we could do something better than bowls for the children of Atekyedo.

On our way back to Winneba, we stopped at another basic school to see how they promote proper sanitation. This school had built a handwashing station that managed to have reservoirs to hold clean water they gathered from the school's tap and were able to hang bottles of soap for students to use to wash their hands.

By stepping on a pedal that was attached to the Frytol container, water would streamline out of the hole and onto the hands. This helped to reduce unnecessary touching of the container, so hands could be cleaner after washing.

The following day, we spent our time collecting estimates from local shops and spoke to a local carpenter named Kwame. The price estimates are as follows:

- Rope (x 2) - GHc15
- Metal hooks (x 6) - GHc20
- Wood - GHc64 total
    - 2x2 - GHc8
    - 2x6 - GHc48
    - 1x12 - GHc8
- Planning and transport fee - GHc25
- Labor fee for carpenter - GHc50
- Hand soap - GHc18
- Soap-making supply kit (x 2) - GHc64

The following night, Kwame sent two of his assistants over to help us start to cut the wood. We paid for them to plane the wood and transport to the school for installation the next day.

The next day, Kwame and his two assistants met us at the M/A Basic School in Atekyedo. They did most of the digging while we held the three posts in place.

The children at the school gathered most of the stones that were to be placed under the station to prevent mud from collecting.

A few days later, we officially presented the handwashing station after we made soap with the children and talked to them about the importance of proper hygiene.

Educational Curriculum

The vision we have for this educational curriculum is for the benefit of ISHEW. In the future, we hope that GVSU students will have the opportunity to teach our classes in schools while studying abroad in Ghana. These classes will focus on health, hygiene and sanitation for students in primary one through three.

This curriculum will consist of five lesson plans that will be taught once a week in each school over a five-week period. Since each school would only receive one lesson each week, this allows for multiple schools to be enrolled in the curriculum during the same five-week period. If time allows, it would be beneficial if the lesson from the previous week could be reviewed.

Tips for Teaching

- Use the chalkboard for main topics of the lesson. Bring chalk to write on the board.
- The teacher leads the class verbally rather than on the board.
- Ask the children lots of clarifying questions about the material.
- Be sure that the students understand what you are saying or asking.
- Children raise their hands and stand when giving their answer.
- Encourage the class to clap when a student answers correctly.
- After each student answers, respond with “good” or “very good.”

Week One: Water Cycle

Content

The Earth has a limited amount of water. Water continuously moves on, above and below the surface of the Earth. This is called the water cycle. Water evaporates into the air creating moisture. When this happens over a period of time, clouds form. From the clouds, rain then falls to the Earth. This rainwater is a source of drinking water.

This rainwater then feeds into local rivers and lakes. Rainwater can eventually reach the ocean, too. Rivers and lakes are sources of surface water. Surface water is another source of drinking water.

And again, water in the ocean and on land evaporates and the cycle repeats.

Household water can come from groundwater, surface water, or rainwater.

On The Board

Water Cycle: Evaporates into the air as moisture, creates clouds and falls to the Earth as rain
Rainwater: Water that falls from the clouds to the Earth
Surface water: Water from rivers and lakes
Groundwater: Water that seeps into the ground and is stored in aquifers

Script*

Teacher: Good morning. How are you?

Class: I'm fine, and you?

Teacher: I am also fine. Today we are going to learn about the water cycle. The water cycle is when water from the Earth evaporates, forms clouds, and then returns to the Earth as rain. Class, what happens during the water cycle?

Student: (answers when called on, correct as needed)

Teacher: When water evaporates from the Earth, forms clouds and then returns to the Earth as rain, it is called the water cycle. When rain falls to the Earth, it is called rainwater. Rainwater is one source of drinking water. Class, what is rainwater?

Student: (answers when called on, correct as needed)

Teacher: Rainwater comes from the sky when it rains. Rain feeds rivers and lakes. Rivers and lakes are surface waters. Surface waters are a source of drinking water. Class, what two bodies of water make up surface water?

Student: (answers when called on, correct as needed)

Teacher: Rivers and lakes make up surface water. Some water also seeps into the ground and is stored under the Earth in aquifers. This water is called groundwater. Groundwater can be used for drinking water. Class, what kind of water is stored under the Earth's surface in aquifers?

Student: (answers when called on, correct as needed)

Teacher: Groundwater is stored under the Earth's surface in aquifers. It is likely that your water comes from groundwater, surface water, or rainwater. It is important to ensure that this water is clean when you drink it. You should not drink water from the same place where people defecate or where you wash dishes or laundry. Class, what are the three sources of drinking water?

Student: (answers when called on, correct as needed) Answer: Rainwater, surface water, and ground water.

Teacher: Very good, does anyone have any questions?

**This script is a sample and may be modified to fit time constraints.*

References

Centre for Affordable Water and Sanitation Technology. (2011). *Water cycle and sources*. Calgary AB, Canada: CAWST.

Week 2: Handwashing

Content

Bacteria can be transferred from our hands and into our bodies through our mouths, nose and eyes. This transfer can be stopped if hands are properly washed.

The three times when we should wash our hands are before cooking or preparing food, before eating and after using the toilet.

Steps for Washing Hands:

1. Wet your hands with clean water and apply soap.
2. Rub your hands together and scrub them well; be sure to get the backs of the hands, between your fingers and under your fingernails.
3. Continue rubbing your hands while singing the ABCs.
4. Rinse your hands under running water.
5. Allow hands to air dry or dry them with a clean cloth.

We need to wash our hands properly to remove bacteria from our hands. It is best to wash hands with soap. We also need to be careful when drying our hands so they do not become dirty again.

On The Board

Steps for Washing Hands:

1. Wet your hands with clean water and apply soap.
2. Rub your hands together and scrub them well; be sure to get the backs of the hands, between your fingers and under your fingernails.
3. Continue rubbing your hands while singing the ABCs.
4. Rinse your hands under running water.
5. Allow hands to air dry or dry them with a clean cloth.

Script*

Teacher: Good morning. How are you?

Class: I'm fine, and you?

Teacher: I am also fine. Today we will be learning about why it is important to wash our hands and how to properly do so. Bacteria can be transferred from our hands and into our bodies through our mouths, nose and eyes. Class, what three places can bacteria be transferred through?

Student: (answers when called on, correct when needed)

Teacher: Bacteria can be transferred through our mouths, nose and eyes when we touch our hands to these parts. This transfer can be stopped if we wash our hands properly and frequently. Class, how can you prevent the transfer of bacteria into your body?

Student: (answers when called on, correct as needed)

Teacher: By washing our hands, we can prevent the transfer of bacteria from our hands into our bodies. When should we wash our hands?

Student: (ask for many students to contribute)

Teacher: The three most important times to wash our hands are before eating, after using the toilet, and before preparing or cooking food. Class, when are the three times that we should wash our hands?

Student: (answers when called on, correct as needed)

Teacher: Now, we will practice washing our hands. The five steps are on the board. (Read through the steps and demonstrate how to wash our hands.)

*****Have the class practice washing their hands or if they have the equipment to do it for real, do so.***

**This script is a sample and may be modified to fit time constraints.*

References

Centre for Affordable Water and Sanitation Technology. (December 2014). *Technical brief: Handwashing.* Retrieved from http://resources.cawst.org

Centre for Affordable Water and Sanitation Technology. (December 2014). *Technical brief: Sanitation in Challenging Environments.* Retrieved from http://resources.cawst.org

Week 3: Diarrhea

Content

Diarrhea is loose, watery stool that happens more often than usual. When diarrhea lasts for more than a few days, it becomes dangerous. Since diarrhea is a waterborne illness, it is important to avoid drinking contaminated water and to wash hands with clean water.

Proper handwashing and safe food handling are the most important ways of preventing the spread of germs that cause diarrhea. Washing hands with soap is the best way to prevent the spread of germs. Washing hands before preparing, cooking, or eating food is also very important.

People with diarrhea need to keep drinking a lot of fluids to avoid dehydration.

On The Board

Diarrhea: Loose, watery stool that happens more often than usual

Script*

Teacher: Good morning. How are you?

Class: I'm fine, and you?

Teacher: I am also fine. Today, we will be learning about diarrhea, how to prevent it from happening, and what to do if you have it. Can anyone tell me what diarrhea is?

Student: (allow for answers, correct when needed)

Teacher: Diarrhea is loose, watery stool that happens more often than usual. Diarrhea is a waterborne illness, which means that you get it from drinking unclean water and using unclean water to wash food or dishes. To reduce the risk of getting diarrhea, you should drink clean water and wash your hands before preparing or eating food. Class, what are two ways to reduce the risk of getting diarrhea?

Student: (allow for answers, correct when needed)

Teacher: Drinking clean water and washing your hands before preparing or eating food are the best two ways to prevent diarrhea. The best way to get clean water is from a well, tap, or by boiling it. If possible, it is best to wash your hands with soap. Can someone demonstrate or explain how we should wash our hands?

Student: (allow for answers, correct when needed)

Teacher: The five steps to washing our hands are:

1. Wet your hands with clean water and apply soap.
2. Rub your hands together and scrub them well; be sure to get the backs of the hands, between your fingers and under your fingernails.

3. Continue rubbing your hands while singing the ABCs.
4. Rinse your hands under running water.
5. Allow hands to air dry or dry them with a clean cloth.
   Demonstrate this while explaining

Teacher: At what times should we be washing our hands?

Student: (allow for answers, correct when needed)

Teacher: We should definitely be washing our hands after using the toilet, before preparing or cooking food, and before eating. What are three times we should be washing our hands?

Student: (allow for answers, correct when needed)

Teacher: Very good. Now, can someone tell me what diarrhea is?

Student: (allow for answers, correct when needed)

Teacher: Diarrhea is loose, watery stool that causes dehydration. It is important to drink lots of fluids in order to prevent dehydration. When someone becomes too dehydrated, they have to go to the hospital. Class, how can be prevent someone from becoming too dehydrated?

Student: (either by drinking lots of fluids or washing hands, correct wrong answers)

Teacher: We must keep the dehydrated person drinking lots of fluids especially clean water. Class, how can we prevent diarrhea?

Student: (by washing our hands, correct wrong answers)

**This script is a sample and may be modified to fit time constraints.*

References

Centre for Affordable Water and Sanitation Technology. (December 2014). *Technical brief: Handwashing.* Retrieved from http://resources.cawst.org

Ojore, G. (2012, April 12). 2,000 Children Die of Diarrhoea in Africa Daily – WaterAid. *Africa News Service*. Retrieved from http://go.galegroup.com.ezproxy.gvsu.edu/

Week Four: Microbes

Content

Though there are many things in the water that you can see, such as plants and animals, there are microscopic creatures that are even more abundant. These are called microbes because they can only be viewed with a microscope. Though microbes are found essentially everywhere on the planet, we will focus on those that spread via the water system because there are easy ways to prevent the infections that these commonly cause. Microbes are so small that there can be thousands, even hundreds of thousands, in a single drop of water.

Many microbes are beneficial for humans, such as those that inhabit our digestive tracts that help us digest food. Microbes are also used to make many of the foods we eat, such as bread, cheese, yogurt, wine, and more. Some microbes are harmful for humans and can make us very sick. They can cause diarrhea, stomach aches, vomiting, and other infections like colds and flus. Many of these microbes can enter your body when you drink contaminated water. It is very important that you filter, boil, or purify your water before you drink it unless you have access to water from a tap that provides clean water to you. When you are sick from microbes, they can be transferred from person to person if they are excreted in feces and contaminate the water source that other drink from. Animal feces can also contaminate water sources, so it is important to use and drink only water that has been purified, filtered, or boiled.

On The Board

Microscope: A tool that is used to look at things that are too small to see alone with just your eyes
Microbe: An organism that is so small that you need a microscope to see it
Clean water sources: tap, hand-dug well, water from filter, sachet and bottle water
Ways to make water safe: boil, purify, and filter

Script*

Teacher: Good morning. How are you?

Class: I'm fine, and you?

Teacher: I am also fine. Today we are going to learn about microbes. Class, what can you find in the water?

Student: (answers when called on, correct as needed)

Teacher: Plants and animals are some of the things that you can see in the water. There are some things in the water that are too small for us to see. These are called microbes. Class, what lives in the water and is so small that you cannot see it?

Student: (answers when called on, correct as needed)

Teacher: Microbes are organisms that are too small to see. To see them, you need a microscope. A microscope is a tool that lets you look at really small things. Class, what do you use a microscope to look at?

Student: (answers when called on, correct as needed). Be sure to emphasize it is used to see microbes.

Teacher: Microbes can be good for you. There are some in your stomach that help you break up your food. Microbes are also used to make bread and wine. Some microbes can make you very sick. Microbes can cause diarrhea, stomach aches, vomiting, and other infections like the cold. Class, what can microbes do?

Student: (answers when called on, correct as needed). Ask several students for answers.

Teacher: Many microbes that can make you sick come from the water you drink. It is very important to filter, boil, or purify your water before you drink it unless you have access to water from Winneba water works (or other one as fits). Class, if you do not have purified water, what should you do to it before you drink it?

Student: (answers when called on, correct as needed)

Teacher: When you are sick from microbes, it is important to use good sanitation. Use a latrine or toilet to go to the bathroom. Other people can get sick if they come in contact with your feces, especially if it has contaminated the water source that others drink from. Animal feces can also contaminate water sources, so it is important to use and drink water that has been treated. Class, what are some ways that you can make sure your water is safe to drink?

Student: (answers when called on, correct as needed).

Teacher: Very good, does anyone have any questions?

**This script is a sample and may be modified to fit time constraints and to be specific to the location of the school.*

References

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Week Five: Malaria and Other Diseases

Content

Microbes and parasites that commonly cause infections in Ghana are waterborne. These waterborne diseases can be prevented with better health and sanitation practices. Diseases such as malaria, cholera, oncho, and guinea worm can be contracted from or near a contaminated water source.

Malaria is caused by a parasite that is transferred by mosquito to people. This causes fever, sweats, head and body aches, nausea and vomiting. Malaria can be prevented by using mosquito nets and by making sure there is not standing water nearby that would allow for mosquito breeding.

Cholera is a bacteria that infects people after ingestion of water that has been contaminated by another infected person's feces. Its symptoms are diarrhea and in some more severe cases vomiting and leg cramps. Cholera can be prevented by boiling, or chemically treating a water source before consumption.

Oncho, short for Onchocerciasis, is commonly known as river blindness. One can contract oncho after repeatedly being bitten by blackflies that often live near rivers. This causes blindness and skin irritations. Oncho can be prevented by wearing protective clothing when approaching a river.

Guinea worm is a disease caused by drinking contaminated stagnant water. It is also known as hanging worm because the parasite often slowly exits the body through the leg or foot. This can be prevented by filtering, boiling, or chemically treating contaminated water.

The 5 f's (Fluids, fingers, flies, food, and fields) are an easy way to remember the ways that organisms can be transmitted. Fluids, fingers, flies, food, fields are all ways that transmission can occur. Drinking contaminated water (fluids), soil and crop contamination by poor sanitation (fields), contamination of hands that will prepare food or enter the mouth fingers), eating contaminated food (food), and flies spreading disease from feces to food/water/people (flies) can all transmit infectious microorganisms. It is important to prevent disease by washing your hands, using the latrine or toilet when defecating, using mosquito nets, getting vaccinated, and by boiling/filtering/treating a water source.

On The Board

Microbe: An organism that is so small that you need a microscope to see it
Parasite: An organism that lives off of another organism
The 5 f's: fluids, fingers, flies, food, fields
Malaria
Cholera
Oncho (river blindness)
Guinea Worm

Script*

Teacher: Good morning. How are you?

Class: I'm fine, and you?

Teacher: I am also fine. Today we are going to talk about malaria and other diseases. Class, who can tell me what a microbe is?

Student: (answers when called on, correct as needed)

Teacher: Very good. Microbes are small organisms that are too small to see with our eyes. They can be found in the water and can make us sick. Parasites can also be found in the water and can make us sick. Parasites are organisms that live off of another organism. Class, some microbes and parasites can be harmful to us. Where is somewhere that they can be found?

Student: (answers when called on, correct as needed)

Teacher: Good. Class, can you say malaria? (Wait for them to say it as a group). Do you know what malaria is?

Student: (answers when called on, correct as needed, students may not have an exact answer, just gauge their knowledge)

Teacher: Very good. Malaria is a parasite that you can get by being bitten by mosquitoes. If you have malaria you could have a fever, sweats, head and body aches, nausea or vomiting. Malaria can be prevented by using mosquito nets, and by making sure there is not standing water nearby. This causes X symptoms. Class, how can malaria be prevented?

Student: (answers when called on, correct as needed).

Teacher: Good. Another disease we will talk about it cholera. Class, can you say cholera? (Wait for them to say it at least once as a group). If you drink dirty water you could get a cholera infection. If you have cholera, it will give you diarrhea and sometimes make you vomit. Cholera can be prevented by boiling, or chemically treating a water source before you drink it. Class, if you have cholera, what might happen to your body?

Student: (answers when called on, correct as needed)

Teacher: Good. Can you say oncho? (Wait for them to say it as a group). Oncho is also known as river blindness. You can develop oncho if you are bitten many times by blackflies that live near some rivers. If you are bitten by these flies too many times, you will probably also have a skin rash. Oncho can be prevented by wearing protective clothing when approaching a river.
Class, how can you prevent oncho?

Student: (answers when called on, correct as needed).

Teacher: Very good. Can you say Guinea Worm? (Wait for class to say it together). Guinea worm is a disease caused by drinking dirty, still water. It is also known as hanging worm because the worm slowly leaves the body through the legs or feet. This can be prevented by filtering, boiling, or chemically treating contaminated water.
Class, how can you prevent Guinea Worm?

Student: (answers when called on, correct as needed).

Teacher: The 5 f's (direct to the list on the board) are an easy way to remember the ways that diseases can spread. Some ways that diseases can spread are by drinking contaminated water (fluids), soil and crop contamination by poor sanitation (fields), contamination of hands that will prepare food or enter the mouth fingers), eating contaminated food (food), and flies spreading disease from feces to food/water/people (flies) can all transmit infectious microorganisms. Class, can you tell me the 5 ways that diseases can spread?

Student: (answers when called on, correct as needed, go through all 5 f's).

Teacher: It is important to prevent disease by washing your hands, using the latrine or toilet when defecating, using mosquito nets, getting vaccinated, and by boiling/filtering/treating a water source.
Class, can you tell me what disease is prevented when you use a mosquito net?

Student: (answers when called on, correct as needed).

Teacher: (can review other diseases and/or any of the subjects covered in the lesson plan). Very good, does anyone have any questions?

**This script is a sample and may be modified to fit time constraints and to be specific to the location of the school.*

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