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Safe water, better health!

Hygiene promotion manual for primary schools

Kenya Water for Health Organization

Foreword

Every 15 seconds, a child dies from a disease attributable to unsafe drinking water – every 15 seconds a family tragedy, every 15 seconds a disgrace for humankind. Technical solutions are available to provide access to safe drinking water, and better education on safe water, health and hygiene can prevent further tragedies.

Siemens Stiftung is committed to ensuring a sustainable supply of safe drinking water in rural and peri-urban areas in developing countries. Our water projects apply innovative, yet simple technologies, combined with social business models for small entrepreneurs, with a clear focus on building long-term and self-sustainable infrastructures.

Education and training is absolutely crucial to this approach – both play an important role in reducing the prevalence of waterborne diseases and child mortality.

Hence, we have developed a discovery-based training approach which uses hands-on experiments to promote awareness and understanding of the terrible consequences of unsafe water and poor sanitation.

According to the generations-old wisdom “we can believe what we actually see,” Siemens Stiftung encourages training participants to independently experiment and explore the broad context that encompasses health, safe water and hygiene.

The hygiene promotion kit “Safe water, better health” is designed to serve as a guide, planning tool and inspiration for primary school teachers. The kit consists of a training manual in combination with illustrations and an experimentation box.

The kit also provides information on teaching methodologies and covers planning, key messages and learning activities, including background on the materials needed to conduct the experiments.

We very much hope that this hygiene promotion kit helps local communities stop the spread of waterborne diseases and improve their health and that it assists them in making their surroundings healthy environments.

We look forward to working together with you and wish you the best of success!

Rolf Huber

Executive Director
Siemens Stiftung

Contents

ENCOURAGE. empowering people.
The Siemens Stiftung wants to empower people to actively address today's social challenges. Together with partners, the foundation designs and implements local and international projects with the aim of promoting individual responsibility and self-initiative. The foundation is committed to enlarging basic services and social entrepreneurship, promoting education and strengthening culture. The Siemens Stiftung pursues an integrative approach and stands for responsible, impact-oriented and innovative project work.

Methodology

How is this training designed?

This manual is designed to assist primary school teachers and head teachers to teach school children between the age of 5 and 13 years towards health, water and hygiene. Hence, the aim is to improve the health and hygiene status at schools and also in the community as a whole.

The lessons pursue a participatory and experimental approach to enable children to prevent themselves and their families from water- and hygiene-related diseases.

It is highly recommended to apply this manual as a complete training on health, water and hygiene. The messages and information given in the different chapters build on each other. Especially health patrons, school water and/or health committees or other responsible bodies within the school should receive the whole training.

However, in order to meet the schools' needs and demands, which might vary from one school to the next, this teaching manual pursues a modular approach. This means that the manual can also be applied as part of the syllabus in order to make teaching more efficient and interactive.

Due to syllabus requirements, the modules can be chosen and combined. There are special recommendations given at the beginning of every chapter.

This manual is based on the "Participatory Health and Sanitation Transformation" approach (PHAST), developed by WHO together with the UNDP Water and Sanitation program, and the educational program "Experimento". [i]

"Experimento" is based on the pedagogical concept of HdkF which emphazises

- independent thinking through experimental teaching
- self-reflection
- development of questions and answers jointly by children and teachers
- integration of relevant topics into children´s everyday world.

Who participates?

It is recommended to provide this training to every class in primary schools on a regular basis. Special emphasis might be put on health committees and water patronages.

This training manual can be applied either as a separate training or in the course of regular lessons concerning health, water and hygiene issues.

Basically, every child can attend this training. Main target groups are:

- School children at the age of 5 to 13 years
- Health patrons
- Health club members
- Water committee members

The manual is meant to contribute to better health and hygiene standards within the school and outreach also to the community.

How to use this manual

This manual consists of five lessons. Every lesson is subdivided into four parts:

- Information for the teacher
- Agenda planning
- Content preparation
- Summary of key messages

It is recommended to do one training lesson at a time. This means that the whole training requires 5 lessons of 1 ½ hours each (about 7 ½ hours in total).

Teachers know their schools and curriculum requirements best and decide themselves how to adapt this content to their lessons. It is recommended to conduct the training as a whole, and afterwards adapt parts of it within the normal school lessons according to the syllabus.

The links to the syllabus thus do not mean to only take parts of the training for the year referred to, they rather indicate where elements can be repeated during the general course of lessons to thereby let the pupils once more focus their thoughts on the importance of safe water in their lifes.

How to prepare and conduct the training

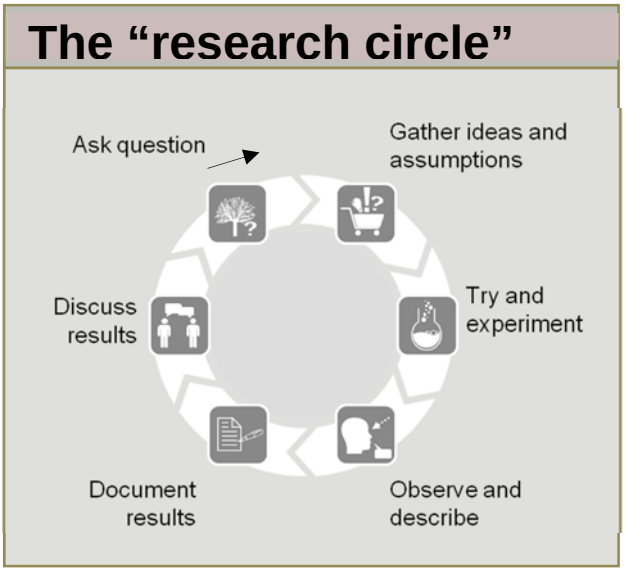
Before starting the training, it is important that you familiarize yourself with the topic and objectives of the training lessons.

Carefully read the teacher´s information, key messages, agenda planning and content preparation and activities.

Prepare the necessary material as it is listed in the lessons´ descriptions, such as material for experimenting, illustrations and a board (or flip-chart) as well as chalk or pens.

Prepare a lesson´s agenda which follows a clear guideline. The “research cycle” describes the different stages of conducting an interactive lesson based on experiments:

1. Start with introducing the topic
2. Make the problem visible through raising questions (which shall be prepared beforehand), then collect and analyze the answers together with the children.
3. Foster problem-solving thinking through deriving possible solutions/behaviors and developing a vision.
4. Conduct action oriented activities such as experiments or community mapping.
5. Let the children observe and describe the results and compare them with initial assumptions.
6. Deduct a key message from these observations and repeat these key messages at the beginning and at the end of each lesson.



General tips for teaching

Create a friendly atmosphere.

A friendly and collaborative learning atmosphere is crucial to motivate children to understand the message and to thus also change their behavior. Point out that there are no "wrong" or "false" contributions. Let the children freely express their thoughts and observations.

Build on what the children already know and observe.

Children make their own observations and experiences, so in most cases children will already be familiar with the topics addressed. Listen to their observations and assumptions and include them into a common discussion.

Talk with the children.

Dialog helps people to understand the issue. It is better not to explain too much, but to ask questions instead. When elaborating on a topic, make sure that the message is clear and precise, so that the children can easily understand the point.

Encourage to think.

It makes no difference whether children bring up a supposedly "wrong" idea – you can point out in an appropriate moment that an assumption did not hit the mark. This allows them to develop an alternative theory or idea on their own.

Encourage to ask.

In Europe there is a saying "Who does not ask remains stupid". Encourage children to ask every question which might come to their mind, until they can see the idea clearly.

Know your target group.

Teaching young children requires empathy. In order to make them understand the key messages, we recommend trying to looking at the world with their eyes.

Make it fun.

Humor makes a training lesson more engaging, participative and enjoyable. And it leads to better results. However, allow a relaxed training atmosphere and do not take yourself too seriously.

Teaching methods

Think – Pair – Share

In order to focus pupils' interest on an idea and to discuss in detail, you can use the method "think – pair – share", which even works for classes with a lot of students. You begin by posing a question such as "What have germs got to do with illness?" The pupils are at first asked to try to find an answer on their own and to take some notes (think). Then they exchange their ideas with their seating neighbor (pair). Two pairs then combine to form a group of four e.g. by turning to their neighbours in front or behind them. Finally, these groups present their shared results to the full class (share).

Learning at Stations

This approach combines two major aspects of teaching and learning: It lets the pupils carry out simple experiments and it lets them work and learn together in small groups. This method is suitable for topics which can be divided into tasks and activities of similar size (time duration), e.g. building a circle of 6 learning stations dealing with the water cycle: 3 stations could be experimental (water solving salt, water evaporating by the energy of the sun, residues after evaporation), 3 further stations could be paper and pencil tasks like labelling a sketch of the water cycle, solving a crossword puzzle referring to the water cycle and similar tasks. The class will then be devided into groups of e.g. 4 pupils who start at one station and move to the next when finished. Depending on the size of the class, the stations have to be set up twice or the group size has to be changed.

Methodology tools

Often it is useful to prepare tasks and worksheets that the pupils can work on independently – as with the non-experimental stations described above. There are many tools to help construct appropriate tasks like a crossword puzzle or memory cards. With such worksheets the pupils can repeat and train the proper use of technical terms and expressions. A set of memory tyles referring to hygiene can be used to let the pupils combine pairs of pitures with terms, for example germs as a word to be combined with the sketch of germs under a microscope, or for example images of common methods to make water safe for drinking to be combined with the corresponding expressions, and so on. Further descriptions of the methodology tools can be found on the mediaportal of the Siemens Stiftung: www.medienportal.siemens-stiftung.org

Games

Whenever possible let your pupils play some simple games. In one of the hygiene sessions suggested, a “finger game” is described to follow the idea of the water cycle and to make it vivid. Other games like the above mentioned memory game help pupils to memorize terms as well as to consolidate knowledge and even habits like proper hand washing.

Even group building – e.g. by letting pupils work at different stations – can be introduced in a playful way: To let them work in groups of four, cut a fitting number of picture postcards or sketches related to the subject into four pieces and mix these in a box. Let each pupil take one piece and find the missing pieces and thus his partners.

Modules

Lesson 1: Water is life

Information for the teacher

References to the Syllabus: According to the Kenyan syllabus, Lesson 1 is applicable in class:
Standard 1: Water – Water sources
Standard 7: Water – Water pollution
Standard 7: Properties of matter – Evaporation

Objectives: The first lesson explains the importance and usage of water. After this lesson, children shall know about the importance of water for every creature on earth. Furthermore, they shall be able to describe how the water cycle works and how water gets polluted.

Methodology: Pictures, Experiments, Illustrations, Game, Discussion

Time required: 1 ½ hours

Material to be provided:
Board or flip-chart, pens/markers/chalk
Material for experiments
Illustration manual

Agenda planning

Time	*Topic*
10 minutes	Welcome and introduction
40 minutes	Topic 1: Water is life Experiment “Water is limited and a precious resource” Experiment “Water cycle in a bag” Experiment “Water cycle in a bag – part II” Game “Water cycle hand and finger game”
30 minutes	Topic 2: Water pollution Experiment “Water dissolves pollutants” Experiment “Water as a solvent”
10 minutes	Summary of key messages

Content preparation

Welcome and introduction

Introduce the topic of safe water, health and hygiene to the children. Create a friendly atmosphere and tell them, that there are no wrong questions. Ask them questions and let them freely answer them.

Topic 1: Water is life

In order to introduce the topic ask the children about their observations and knowledge towards water and collect their answers on the board. Use the pictures and illustrations provided in the illustration manual.Then provide the following information.

Water is important to every creature on earth, also to human beings. Without water there wouldn´t exist any life on our planet.

Is water always available? Do you know areas or regions, where there is no water? How does nature look like if there is no water/plenty of water?

Water is important to all creatures and it is not always available. Water is necessary to life itself, so in deserts there is only little life, because there is almost no water. In the jungle there is plenty of water, so there is a lot of life.

Desert

Jungle

Why do human beings need water?

The human body consist of water to 65% (in average). It is in our cells, blood, muscles, even bones. Without water, the body dries out. Nobody can survive without any water.

How long can a human being survive without any water?

Indeed, there is no exact amount of days to be mentioned here as this depends on several factors, such as age, health condition and ambient temperatures, among other factors. However, a human being cannot survive more than a few days without drinking any water.

Worldwide, how much water is available for human use?

To illustrate the amount of water available for human use, continue with the following experiment.

Activity 1

Experiment: Water is limited and a precious resource

Topic: Availability of water

Material to be provided:

- 500 ml plastic cup
- table spoon
- 100 ml plastic cup
- 1 ml syringe
- small piece of aluminum foil (optional)

Additionally:

- clear water

Question: Worldwide, how much water is available for human use?

Description:

Fill a plastic cup with 0.5 l water. Tell the children that this represents the total amount of water on earth – both salty *and* sweet water resources.

Take a soup spoon full of water from this big plastic cup and put it into another smaller one: The remaining water in the big beaker represents the salty sea water. The water in the smaller beaker now represents all sweet water resources on earth.

Extract one drop with a pipette, small syringe or straw and let it fall on the desk or ground: The remaining water in the smaller beaker represents the sweet water on earth stored in glaciers and icebergs.

The drop represents the sweet water which is available for human use. 2/3 of this drop is used for agriculture and the industries. Only 5 percent of this drop is available as drinking water.

Explanation

This experiment shows that only 3 percent of the earth´s water is sweet water, 97 percent is salty water in the oceans. Then again 75 percent of the sweet water is bound in glaciers and poles. Of the remaining water 75 percent is used for agriculture and the industries. This means that only a small amount of that little drop of water is available for human use, like drinking, cooking, bathing, washing clothes etc.

Message:

Water is a very precious resource. It is limited and needs to be protected.

However, how old is the water we use? Is it always the same water?

Continue with an experiment to illustrate the water cycle.

Activity 2

Experiment: Water cycle in a bag

Topic: Water cycle

Material to be provided:
- zip-plastic bag
- marker pens of different colors

Additionally:
- soil
- clear water
- small branch of tree or bush with leaves

Question: How does the water cycle work?

Description:

Draw with a marker pen a sun and some clouds in the upper part of a zip-bag. Fill the bag about one finger high with some soil and water. Place a branch with leaves in the bag and close it. Expose the bag to the sunlight and watch the changes.

Let the children observe and describe what happens inside the plastic bag.

Explanation:

The water evaporates by the energy of the sun. The water vapour condenses on the slightly cooler surface of the plastic bag. Water droplets form and “rain” down. This explains how the water cycle works: Water from rivers, lakes and the ocean evaporates as water vapour; it cools down in the stratosphere and forms clouds. The clouds get heavier and heavier and rain starts falling to the earth. The whole process starts again and again.

Message:

Water on our planet continuously changes its appearance in a permanent cycle. However, the water remains the same all the time.

Activity 3

Experiment: Water cycle in a bag – part II

Topic: Self cleaning effect of the water cycle

Material to be provided:
- zip-plastic bag
- marker pens of different colors
- food colorant

Additionally:
- clear water

Question: What happens to polluted water when it evaporates?

Description:

Draw on a second bag again a sun and clouds. Fill the bag one finger high with water which you have colored with food colorant and expose it to the sunlight. Let the children observe if the color condenses with the water.

Explanation:
One can observe that the drops condensing at the upper part of the bag are clear – having left the dye back down. The clear drops show that the water cycle includes a self cleaning process: dissolved substances are left behind when water evaporates. When it condenses to build drops it is free of what was dissolved before.

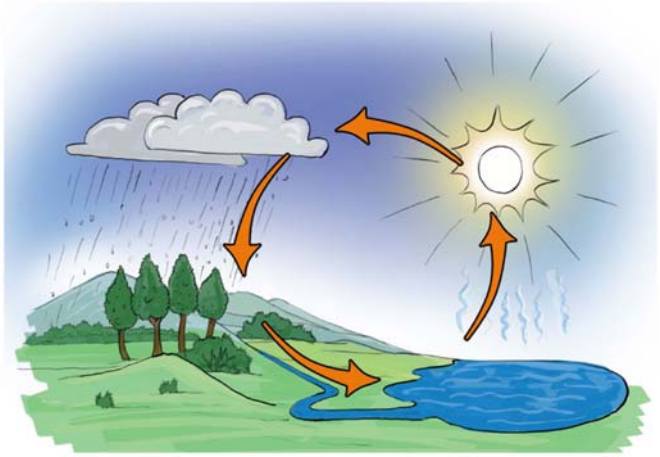
Message:

Water continuously changes its form of appearance: water condenses from the puddle, rises into the sky in form of water vapour and forms new clouds. More condensed water let clouds become heavier. Then water drops and it starts to rain again. Rain water flows into rivers, lakes and the oceans, and the water cycle starts anew. This process has a self-cleaning effect.

Continue with an interactive game to make the water cycle vivid. Put a glass of water on the table. Ask the pupils to take a good long look at the water and ask them to guess how old they think the water is. Gather their guesses, and then tell the pupils that you will give the answer after the next activity. To visualize the water cycle, use illustration in the illustration manual.

Activity 4

Water cycle hand and finger game



Topic: Water cycle

Material to be provided:
- 500 ml plastic cup
- illustration of water cycle

Question: How old is water? Is water always the same?

Description:

Play a game together in which the children pretend to be rain. Ask them to put their arms in the air and then bring them down towards the floor while waggling their fingers. Tell the children to drum on the floor with their fingers to simulate the sound made by rain. Have the children all join their hands together. Ask them what happens when a large number of water drops flow together. The children will doubtlessly know about (rain) puddles.

When the air is warmed by the sun, the water drops from the puddle rise back into the sky again in the form of water vapour, and new clouds are formed. When the children have all raised their hands in the air again, the clouds become heavier and heavier. Clench your fists to demonstrate this. It doesn't take long before it starts to rain again – the children start lowering their hands down to the ground again while waggling their fingers.

Explanation:

The children make many observations of their own based on different weather situations. The game provides a first fundamental understanding of weather. The rain falls on the ground and assembles, for example, in puddles. The sun heats the water in the puddle and causes it to evaporate. The water vapour rises into the sky in the form of moist air. In the higher atmospheric layers, the air cools down again, and the "invisible water" from the puddles condenses into water droplets from which clouds are formed. Small water droplets combine to form larger drops. If these become too heavy, the water falls down to the earth again as rain.

Explain to the children that the earth has a limited amount of water. That water keeps going around and around and around and around. Explain to them that the water in the glass may have fallen from the sky as rain just last week, but the water itself has been around pretty much as long as the earth has. The glass of water they see was once part of the ocean, another time it was part of the lakes and so on. That is what we call the "Water Cycle".

Message:

Water on earth always remains the same water – it is as old as the earth itself.

Topic 2: Water pollution

This section introduces the topic of water pollution and answers the question how water gets polluted.

How does water get polluted? *Let the children think about it. Then continue with the following experiment to demonstrate how water dissolves different substances.*

Activity 5

Experiment: Water dissolves pollutants

Topic: Water pollution

Material to be provided:
- 100 ml plastic cup (2x)
- cardboard (20x10 cm)
- aluminum foil
- table spoon
- table salt
- food colorant

Additionally:
- clear water

Question: How does water get polluted?

Description:

Form a channel made of cardboard and cover it with aluminum foil. Bring it into a slanted position.

a) Put a teaspoon of salt near the top of the channel. Pour some water into the channel so that it must pass the salt on its way. Let the water run down all the foil-coated cardboard and collect the liquid in a beaker.

b) Repeat the experiment after you added a drop of food colorant to the salt and collect the liquid in another beaker.

Observe how water, salt and food colorant behave. Compare the results of both experiments.

Explanation:

Water is a basic medium of life for its ability to solve and transport lots of substances. Water dissolves a wide range of substances including substances which pollute water. But it cannot always be seen with the naked eye whether substances are dissolved or not.

Message:

Water is a solvent. It dissolves many different substances on its path to a river, lake or into the ocean. In consequence, it gets polluted very easily.

To fully understand how this works, continue with the next experiment.

Activity 6

Experiment: Water as a solvent

Topic: Water as a solvent

Material to be provided:

- 100 ml plastic cup
- kitchen paper towel
- black fiber pen, water soluable

Additionally:

- clear water

Question: Which colors are contained in the color black?

Description:

Produce flowers with blossoms and stems as described in the following: Take three sheets of kitchen paper towel, place them over each other, fold up once and again to the side. Then cut the outlines of leafs out of the kitchen paper towel at the two open sides. At the remaining corner, where the kitchen paper towel is held together, cut a small piece off. Unfold the “flower” now and use the remaining piece of kitchen paper towel for making a stem as you wind it together and put it through the hole in the middle of the “flower”. Draw onto the blossom around the stem a circle with a black fiber pen and put the flower into a beaker filled with around 20ml clear water. Wait for about 20 minutes to see what happens. What can be observed? What happens to the black circle?

Explanation:

The rising water separates the black dye into various colors and dyes the petals. After a while, the blossom of the flower shines in various colors. Black isn´t always black, there are many different colors in black color.

Message:

Water dissolves the different substances in the color black. The experiment shows that different substances can be made visible because of their solubility (in water).

Summary of key messages

1. Water is life! It is limited and a very precious resource.
2. The water on our planet continuously changes its appearance in a permanent cycle: from water into clouds, rain, water drops, rivers, lakes and the ocean, water vapours and clouds again. This is called the water cycle; it has a self-cleaning effect.
3. Water is a solvent and can get polluted very easily.

Lesson 2: Water pollution and waterborne diseases

Information for the teacher

References to the Syllabus: According to the Kenyan syllabus, Lesson 2 is applicable in class:
Standard 2: Health – Hygiene
Standard 3: Health – Good health, Cleaning latrines, toilets and urinals
Standard 6: Water – Waterborne diseases

Objectives: The second lesson explains the difference between clean and safe water. It refers waterborne diseases to the consumption of contaminated water and gives profound information on waterborne diseases such as diarrhea, cholera and typhoid.

Methodology: Community mapping, Experiments, Illustrations, Discussion

Time required: 1 ½ hours

Material to be provided: Board or flip-chart, pens/markers/chalk
Material for experiments
Illustration manual

Agenda planning

Time	*Topic*
10 minutes	Welcome and recap
20 minutes	Topic 1: Water sources and usage Mapping of water sources
30 minutes	Topic 2: Clear and safe water Experiment “Making pollution visible”
20 minutes	Topic 3: Waterborne diseases Experiment “When plants drink” Illustration of “F diagram”
10 minutes	Summary of key messages

Content preparation

Welcome and recap

Welcome children and do a brief follow-up discussion round on what you have been discussing last time. The feedback can serve as a first indicator if the key messages have been adopted and understood.

Topic 1: Water sources and usage

Water is very important in our daily life and used for many different purposes. Let´s identify the main water sources in the community and map them on a big sheet of paper.

Activity 1

Mapping of water sources

Topic: Water sources

Material to be provided:
- big sheets of paper
- pens of different colors
- illustrations of water sources

Question: Where do we get our water from?

Description:

Mapping involves creating a simple map of the community to locate households and resources, and to stimulate discussion. It is a useful tool for getting all children involved as well as to create a visual analysis of the community situation.

The map can be drawn on a board or flip-chart. In the mapping exercise, all children should be invited to locate their own households on the map and mark it. After locating households and public sites like schools, churches, main roads, rivers and the like, ask the children to draw in the main water sources in their communities.

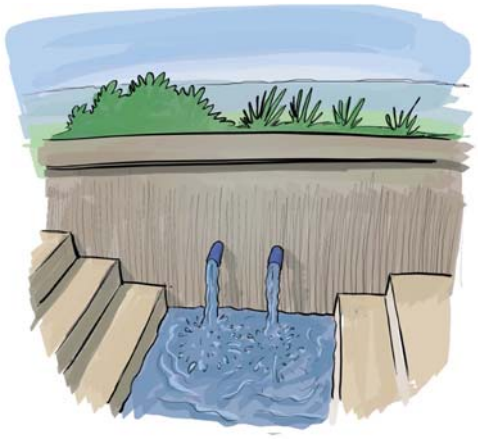
Possible sources to be included in the map:
For inspiration, use illustrations in the illustration manual.

Standpipes

Rainwater Harvesting

Ponds/Wells

Rivers and streams



Protected springs

Boreholes

Lakes

Water kiosks or other water vendors

Please note: *Keep the map, which includes the main water sources as you will need it again in Lesson 5 when the class shall name and map the latrines or open areas people use for sanitation purposes.*

What do we use the water for?

Ask the children about their observations and knowledge towards the usage of water and collect their answers on the board.Use illustrations in the illustration manual.

Possible answers:

- Drinking
- Cooking
- Washing clothes
- Bathing
- For animals to drink
- Cleaning food, utensils, the house, animals
- Gardening flowers and vegetables
- Farming

Message:

Water can be used for different purposes. Safe water is necessary for drinking and cooking as well as for washing hands and cooking utensils. It is also recommendable for bathing and washing clothes.

Topic 2: Clear and safe water

If people drink unsafe water, they might get ill with diarrhea, which is largely due to drinking contaminated water. However, is there a difference between clear and safe water?

Collect some ideas – then provide the following information.

Is clear water the same as clean water?

Clear water means that it is not safe for drinking, because it is contaminated with germs However, you can´t always see if water is safe or not. Water might look clean, but still contain micro-organisms.

What is the difference between clear, clean and safe water?

The difference between clean and safe water is: [ii]

Clean water refers to water that is clear and does not contain any visible substances or particles. However, clear water may still contain micro-organisms which might harm your body and cause diarrheal diseases. People often mistakenly assume that water is safe to drink because it is clear and, therefore, appears to be clean.

Safe water refers to water that contains no germs that could cause illnesses. Boiled or chlorinated water, however, still contains micro-organisms, but these micro-organisms are destroyed and cannot make people sick anymore.Therefore the water is safe for drink or use.

Please note: Explain clearly the difference between clear, clean and safe water as the terms “clear”, “clean” and “safe” are often used interchangeably.

To experience the difference between clean and safe water make the follwing experiment with two glasses of clear water.

Activity 2

Experiment: Making pollution visible

Topic: Water pollution

Material to be provided:
- 100 ml plastic cup (2x)
- candles (2x)
- table spoons (2x)
- table salt
- matches

Additionally:
- safe water

Question: Can we always see and judge if water is polluted?

Description:

Fill two different plastic cups with safe water. Add half a spoon of table salt in one cup and stir until the salt has completely dissolved. Now fill two table spoons to a half each with the different water samples and heat the spoons over a candle light until all the water has evaporated.

Compare the residues on the two spoons and observe: There is a clear difference between the spoon where the sweet water was evaporating from and the other spoon where you can see the remaining salt.

Explanation:

The experiment demonstrates how one can make dissolved substances like salt in water visible. It shows that we cannot judge with our eyes alone, whether certain water is drinkable or not. There might be different substances dissolved even in clear water which we might not see.

Message:

There is a difference between clean and safe water. We cannot always see and judge for sure with the naked eye if water is safely drinkable or not.

Topic 3: Waterborne diseases

Find out what the children know about the connection between the consumption of unsafe water and waterborne diseases. Ask them also about the current situation in their homes with regard to common diseases and hygiene behavior.

Waterborne diseases are common in areas where safe water isn´t always available and/or affordable. Contaminated water can seriously harm the body and is especially dangerous for children under the age of five. This chapter explores how contaminated water affects the body.

Which kinds of symptoms related to waterborne diseases are common?

Collect some ideas – then provide the following information.

Possible answers might be:

- Abdominal pain
- Stomach cramps
- Diarrhea
- Headache
- Loss of appetite
- Malaise
- Vomiting
- Fever
- Fatigue
- Dizziness
- Shivering

These symptoms might refer to diarrheal diseases, which are mostly related to the consumption of contaminated water or food and poor hygiene practices.

To experience the effects of polluted water on our body conduct the following experiment.

Activity 3

Experiment: When plants drink

Topic: Water pollution

Material to be provided:
- 100 ml plastic cup
- kitchen paper towel
- scissors
- food colorant

Additionally:
- clear water

Question: Can creatures develop soundly when living on contaminated water?

Description:

Ask the children if they know what plants feed on. The children are bound to bring up the fact that plants need water to live and grow. Ask the children whether they think that plants also drink dirt that is mixed up in the water. Is polluted water good for plants?

This experiment shows the water transport in plants:
Kitchen paper towel is used to cut a “blossom” and to build a “stem” as it is described in the experimentation instruction on “water as a solvent”. The “flower” is placed into a cup of around 20ml filled with dyed water. What can you observe? What happens to the color of the blossom?

Explanation:

It can be observed how water rises by capillary force and the flower absorbs the dyed water. The blossom gradually changes color.
Plants absorb water from the earth through their roots. From the roots the water travels through the stem to the leaves and flowers. This path can be made visible with the dyed water. Help the children to understand that polluted water does not do the plants any good and can even harm them.

Discussions:

Also ask the children how they feel about the water they drink.

Discuss with the children why it is dangerous to drink contaminated water. During the discussions, emphasize the interlinkages between diarrheal diseases and contaminated water. Outline that diarrhea is dangerous and kills.

Message:

Just like plants take up pollutants in water, we take up pollutants from water as well. However, no creature can live on contaminated water: Consuming contaminated water harms the physical condition and health of people, e.g. diarrhea is such a waterborne disease.

What is a waterborne disease?

Collect some ideas – then provide the following definitions.

DEFINITION:

Waterborne diseases are usually caused when a person drinks, bathes in, washes with or prepares food with water that has been contaminated by bacteria, viruses or parasites, usually from human or animal waste. [iii]

What is Diarrhea?

DEFINITION:

Diarrhea is passing of loose, watery stool 3 or more times for adults or 6 or more times for children within 24 hours. Frequent passing of formed stools is not diarrhea, nor is the passing of loose, "pasty" stools by breastfed babies. [iv]

Diarrheal diseases affect the alimentary canal and are transmitted through ingestion of contaminated food or water with faeces. They are a major cause of morbidity and mortality affecting all age groups, but most seriously children under the age of five years. This is mainly attributed to drinking contaminated water, poor sanitation and hygiene practices.[v] WHO estimates that 94% of diarrheal cases are preventable through modifications to the environment, including interventions to increase the availability of clean water, and to improve sanitation and hygiene. [vi]

Causes:

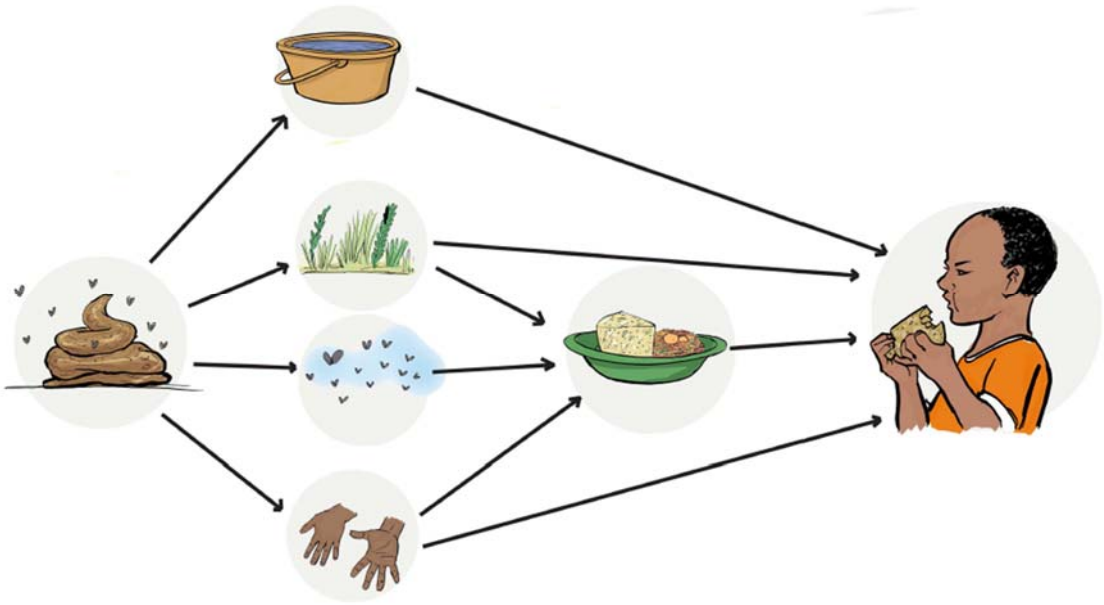
Diarrhea diseases are caused by various pathogenic organisms such as bacteria, viruses, protozoa or helminthes (worms). Other diseases like malaria also include diarrhea, but do not refer to the consumption of contaminated water or food.

Mode of transmission:

Diarrhea diseases are mainly transmitted through ingestion of contaminated food or water. To reduce the diarrhea prevalence, it is important to BLOCK the transmission paths by observing prevention methods.

The general transmission route could be summarized with the 6 “Fs”:
Use illustration of the F-diagram in the illustration manual.

Faeces – home for disease-causing germs
Fluids – carry disease causing germs through contaminated water
Fields – become contaminated by outdoor defecation
Flies – carry and transmit disease-causing germs
Fingers – become contaminated by bacteria that transmit disease
Food – become infected by fluids, flies, or fingers and then ingested through the mouth



Complications:

The major complications of diarrhea, if not well managed, can lead to dehydration, malnutrition, and even to death.

Signs and symptoms of dehydration:

- Sunken and dry eyes, sunken anterior fontenelle – for infants.
- Dry lips and mouth, inelastic skin and no tears
- Shallow breath and shock

Management of dehydration:

- Consume more fluids such as safe water, porridge, soup, rice water soup and eat a balanced diet.
- It is necessary to see a doctor!

Which are the most common Diarrheal diseases? [vii]

DYSENTERY
Definition: Dysentery is bloody diarrhea, i.e. any diarrheal episode in which the loose or watery stools contain visible red blood. Other symptoms may include fever, abdominal pain, and rectal tenesmus (a feeling of incomplete defecation). Individuals will complain of nausea, abdominal pain, and frequent watery and usually foul-smelling diarrhea, accompanied by mucus and blood, rectal pain, and fever. Vomiting, rapid weight-loss, and generalized muscle aches sometimes also accompany dysentery.

CHOLERA
Definition: Cholera is an acute, diarrheal illness caused by infection of the intestine with the bacterium Vibrio cholerae. The infection is characterized by profuse watery diarrhea, vomiting, and leg cramps, rapid loss of body fluids can lead to dehydration and shock. The incubation period can range from a few hours up to 5 days, and it usually takes 2 - 3 days for showing the first symptoms. Cholera infection is very acute and can kill within hours if left untreated.

TYPHOID FEVER
Definition: A systemic infectious disease transmitted by the ingestion of food or water contaminated with the faeces of an infected person, which contain the bacterium Salmonella Typhi.
It can only spread in environments where human faeces or urine are able to come into contact with food or drinking water. Typhoid normally starts with slowly rising temperature, fever fluctuations, malaise, headache, and cough. A bloody nose (epistaxis) is seen in a quarter of cases, and abdominal pain is also possible.

INTESTINAL PARASITES (WORMS)
Definition: Intestinal parasites are organisms, or small animals, that live in the stomach and/or intestines of humans and other animals. These animals take nourishment from the host organism. They can live throughout the body, but most prefer the intestinal wall. The most common types are roundworms, threadworms, pinworms, hookworms, tapeworms, and giardia.

What are the most common signs and symptoms of these diseases?

- Passing of loose, watery stool 3 or more times for adults or 6 or more times for children within 24 hours (diarrhea)
- Abdominal pain
- Vomiting
- Nausea
- Dehydration and the possibility of a circulatory collapse

Treatment:

- If you observe one or more of these symptoms, you need to replace fluids and minerals as much as you can.
- If you observe symptoms like bloody stool, fever, red spots on chest and abdomen or mental dullness, you urgently need to see a doctor!

Summary of key messages

1. Main water sources are lakes, rivers, streams, boreholes, rain harvesting, wells. People use water for drinking, cooking, washing, feeding animals.
2. Clean water is clear water and often mistakenly assumed as safe water. Safe water is water that is free of any micro-organisms (germs) and safe to consume.
3. Consuming contaminated water can harm the physical condition and health of the people.
4. Diarrhea is a waterborne disease. Waterborne diseases are a serious threat to people, particularly to children under the age of five.

Lesson 3: Water treatment methods

Information for the teacher

References to the syllabus: According to the Kenyan syllabus, Lesson 3 is applicable in class:
Standard 2: Water – Cleaning water using a piece of cloth/filtration
Standard 3: Water – Transporting, filtering/boiling, storage
Standard 4: Water – Uses and storage
Standard 6: Water – Water treatment, water storage
Standard 7: Water – Water conservation
Standard 7: Properties of matter – Dissolving liquids in water

Objectives: This lesson outlines the importance of consuming safe water and explains several techniques how to purify water. A special emphasis is put on measures to avoid water (re-) contamination at source, during transport and at storage.

Methodology: Experiments, Case studies, Illustrations, Discussion

Time required: 1 hour 45 minutes

Material to be provided: Board or flip-chart, pens/markers/chalk
Material for experiments
Illustration manual

Agenda planning

Time	*Topics*
5 minutes	Welcome and recap
60 minutes	Topic 1: Water purification Experiment “Compare different samples of water” Experiment “Water filtration by means of a filter” Case Study “Why boling sometimes fails” Experiment “How the SODIS method works” Experiment “Effects of chlorinating water” Experiment “How Membrane Ultrafiltration works”
30 minutes	Topic 2: (Re-) contamination of water Case study “Why paying for water?”
10 minutes	Summary of key messages

Content preparation

Welcome and brief follow-up

Welcome the children and do a brief follow-up on what you have been discussing last time. Repeat key messages of the last lesson.

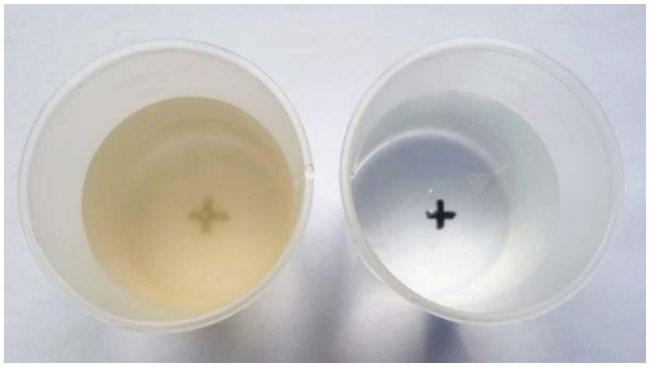
Topic 1: Water purification

Water can be purified by applying different methods. The most common, affordable and effective methodologies are demonstrated here. Water can be purified by physical or chemical treatment methods. Generally, all drinking water must be safe, also water used in food preparation. Water used for washing raw vegetables must be safe as well. For cooking, too, it is necessary to use safe water, unless the cooking process involves boiling for one minute or more. Extra care should be taken when preparing baby food.

Let´s have a closer look at the water which is available in the community and used for daily activities in the following experiment.

Activity 1

Experiment: Compare different samples of water



Topic: Water pollution

Material to be provided:
- 100 ml plastic cup (2x)
- black marker pen
- sheet of white paper

Additionally:
- water samples from different sources used in the community
- safe water

Question: How can we assess the quality of water available in the community?

Description:

Let the children bring or fetch water from some sources nearby / near their homes. Fill the cups to the same level with the different water samples. Place them on sheets of white paper on which you have painted crosses with a black marker. Let the children look through from above to compare turbidity of the different water samples.

Let them compare the quality of the water they brought along. Ask them to discuss the differences: How would they describe them?

Explanation:

The visibility of the black crosses under the cups is rapidly reduced if water is not clear.

Message:

The quality of water can be assessed even with simple techniques. This technique is a first meaningful indicator if the water is clean.

Water Filtration

Turbidity and solids can be removed by using a simple paper filter or by filtering the water through a clean cotton cloth. When applying water treatment methodologies like boiling, chlorination or SO-DIS, the water needs to be filtered before.

Activity 2

Experiment: Water filtration by means of a paper

Topic: Water purification

Material to be provided:

- 500 ml plastic cups (2x)
- kitchen paper towel

Additionally:

- turbid water samples

Question: What gets removed when using a simple filter to purify water?

Description:

Let turbid water go through a filter like paper, tissue or cotton cloth and let the children observe how the water gets clear after passing the filter.

Explanation:

Pollution and turbidity can be reduced by filtering water through paper or a cotton cloth. Before applying a purification method, it is recommended to clear the water by filtering it in order to remove solids, turbidity and suspended matter.

Message:

Before applying water treatment methods like chlorination, boiling or SODIS for example, the water needs to be filtered by means of a clean cotton cloth or at least a paper filter in order to remove solids and turbidity.

Boiling

Boiling makes the water microbiologically safe by killing most types of disease-causing organisms, and it is the most recommended purification technique.

How long must water be boiled to ensure its safety?

Water temperatures at 70° C kill most pathogens within 30 minutes. Water temperatures above 85° C kill most pathogens within a few minutes. So in the time it takes for water to reach the boiling point of 100° C, most pathogens will be killed. The moment your drinking water reaches a rolling boil, the water has already become safe to drink.[viii]

Instead of an experiment, a case study to think about:

Activity 3

Case Study – Why boiling sometimes fails

Fridah lives in Donyo in Thika County together with her husband and four kids. As waterborne diseases often occur in the community, they are very aware of the importance of drinking safe water. Usually, Fridah uses the remaining fire/glow after she has cooked their meals to boil drinking water for her family. Still, her children, especially her youngest 4 year old son Anthony, often suffer from diarrhea and dehydration. What might be the reason?

Let the children discuss in groups of two and then let them share their assumptions with the class.

Possible answers:

- The remaining fire Fridah uses for boiling the water, is not sufficient to properly boil the water and kill the germs in it. Water is safe for drinking after it has reached the boiling point of 100° C, which means when blisters in the water are visible.
- Fridah and her family do not wash food with safe water before consumption.
- Poor hygiene is practiced in the family.

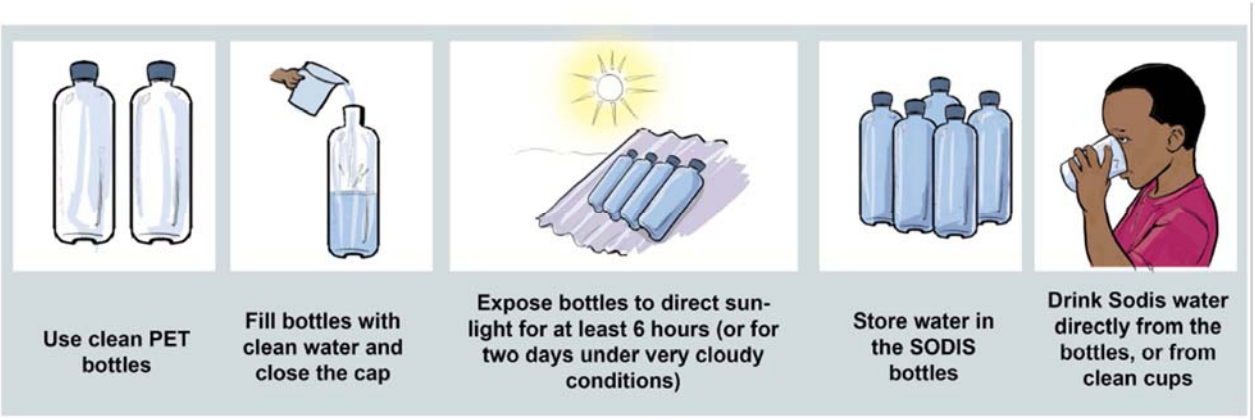
Solar Disinfection (SODIS method)

The SODIS method purifies water by utilization of sunlight passed through a glass media and uses its Ultra Violet (UV) radiation to eradicate germs. Contaminated water is filled in a transparent PET-bottle and exposed to the sun for a certain period of time. The UV-radiation of the sun kills all disease-causing biological agents such as bacteria, viruses, protozoa and worms. This method is recommended by the World Health Organization (WHO) as a viable method for household water treatment and safe storage.

How the SODIS method works[ix]

It is recommended that 6 hours are sufficient under bright to 50% cloudy sky, whereas 2 days of exposure are required for 100% cloudy sky. The treatment efficiency can be improved if the plastic bottles are exposed on sunlight-reflecting surfaces such as aluminum- or corrugated iron sheets.

Procedure



Use illustration in the illustration manual.

What needs to be considered before?

- It is necessary that all physical suspended solids are removed by sedimentation and filtration prior to exposure to the sunlight.
- The bottles should be colorless, transparent PET water or soda pop bottles, with a size of 2 liters or smaller and with few to no surface scratches. The labels are removed and the bottles are washed before the first use.
- To improve oxygen saturation, bottles can be filled to three-quarters, shaken for 20 seconds (with the cap on), then filled completely and recapped. Filled bottles are then exposed to the sun.

What are the advantages of the SODIS method?

- effective against most of pathogenic microorganisms
- relatively safe during storage and use
- relatively cheap and available

What are the disadvantages of the SODIS method?

- Contaminated water is filled in transparent PET-bottles and exposed to the sun. If less than half of the sky is cloudy, six hours will be sufficient to completely disinfect the water. If more than half of the sky is covered with clouds, the bottle must be placed in the sun for two consecutive days.

Activity 4

Experiment: How the SODIS method works

Topic: Water purification

Material to be provided:
- 1/2 litre PET-bottles, colorless (2x)
- hibiscus tea

Additionally:
- clear water

Question: How does UV light kill germs?

Description:

Fill two clean PET-bottles with slightly colored water using diluted hibiscus tea and close them carefully.
Store bottle no. 1 in a shady place, e.g. in a box, and expose bottle no. 2 in bright sunlight. After a while (can be some hours up to one or two days), let the children compare the color of both bottles: The color should have vanished as the dye was destroyed by UV-radiation.

Let the children speculate how the UV rays can bleach colors or kill bacteria.

Explanation:

The powerful UV radiation breaks chemical bonds within the organic material in the treated water and thus kills germs such as viruses, bacteria and parasites.

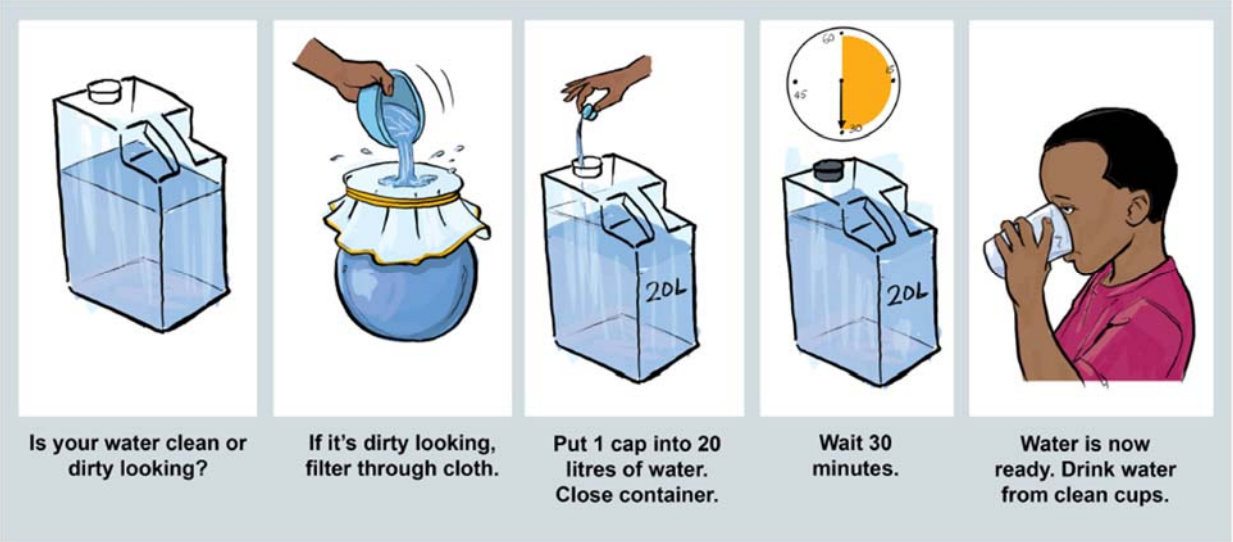
Message:

SODIS is a very simple method to disinfect water. It requires a large supply of intact, clean and adequately sized bottles. The water needs to be exposed directly to the sun for at least 6 hours (bright sunlight) to 2 full days (cloudy sky).

Chlorination

To make water safe by chlorination, a sodium hypochlorite solution (chlorine) is introduced into the water in order to kill germs. Figure below shows the procedures for chlorination. It takes about 30 minutes to let the chlorine agent do its work and make the treated water safe for drinking.[x]

Procedure



Use illustration in the illustration manual.

What are the advantages of chlorination?

- effective against most of pathogenic microorganisms
- relatively safe during storage and use
- relatively cheap and available

What are the disadvantages of chlorination?

- Affects color, taste, and odour of water
- Loses its activity during long-term storage
- Potential danger of gaseous chlorine emission during storage
- For home treatments, there is danger of over-dose incurring long-term health effects

Activity 5

Experiment: Effects of chlorinating water

Topic: Water purification

Material to be provided:
- 100 ml plastic cups (2x)
- hibiscus tea
- sodium hypochlorite solution (e.g. WaterGuard)

Additionally:
- clear water

Question: How does chlorine disinfect water?

Description:

Fill two beakers with the slightly colored water (hibiscus tea) you used with the SODIS experiment. Pour some drops of the chlorine solution into it and let the children observe how the dye is vanishing. There will immediately be a visible difference in color between the two beakers.

Explanation:

When chlorine is added to water, the chemical element dissolves and forms radicals. These radicals kill germs such as bacteria and viruses by breaking the chemical bonds in their molecules or by attacking the cells of the microorganisms.

Message:

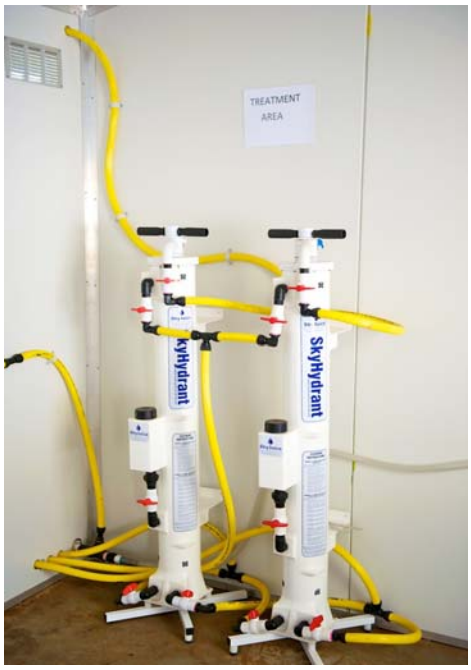
Chlorination is an effective method to make water safe for drinking. But one needs to be careful with the amount of chlorine as using too much chlorine has negative health effects: one bottle cup of Waterguard is sufficient to make 20 litres of water safe to drink.

Membrane Ultrafiltration

Ultrafiltration by membrane system utilizes hydrostatic pressure to force a liquid against a semi permeable membrane. Suspended solids and solutes of high molecular weight are retained, while water and low molecular weight solutes pass through the membrane. Ultrafiltration is very effective in the removal of pathogens from drinking water.

A Membrane Ultrafiltration system called Skyhydrant is used in the Maji Safi Kiosks.

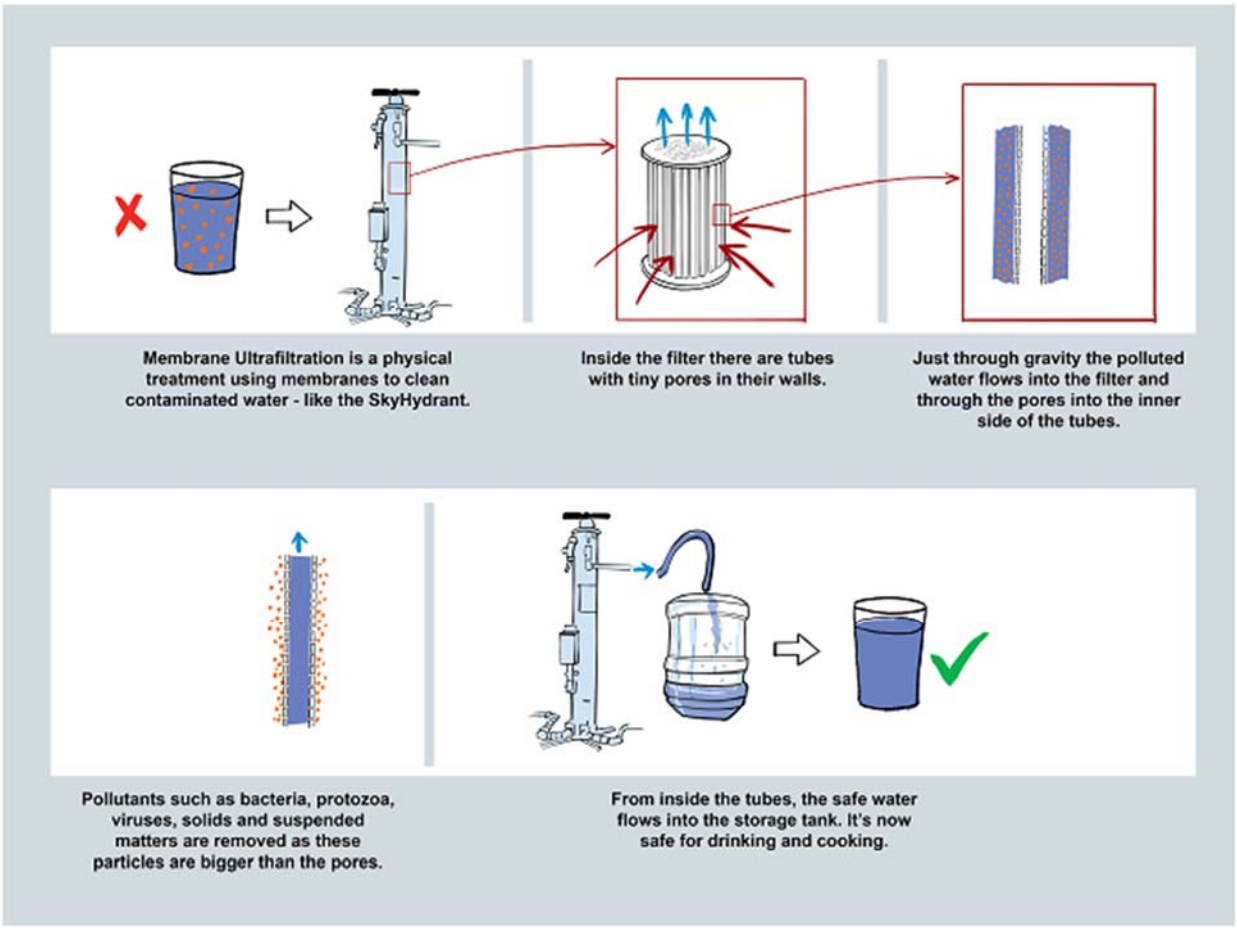
Description of how the Skyhydrant works



The SkyHydrant consists of thousands of micro-porous hollow fibers. Through pressure created by flowing water, turbidity and any solids as well as germs like bacteria, protozoa or pathogens, which have lower molecular weight than water, are removed while water molecules pass through the membrane. No chemicals are required for the filtration process hence the water is pure and safe.

The SkyHydrant can filter up to 700 litres of turbid water per hour and produces up to 7000 litres of drinking water per day. The water is soft and contains no more pollutants or chemicals after the filtration treatment.

Procedure:



Use illustration in the illustration manual.

What are the advantages of membrane ultrafiltration?

- Does not negatively affect the color, taste, or odour of the water as chemicals would do
- Improves the clarity/appearance of water
- Does not require addition of chemical substances
- Some of the membrane ultrafiltration systems, like the Skyhydrant, can operate without electricity

What are the disadvantages of membrane ultrafiltration?

- Requires some maintenance
- Does not remove dissolved substances like salt, floride, arsen or fluids like petroleum

Activity 6

Experiment: How Membrane Ultrafiltration works

Topic: Water purification

Material to be provided:
- single hollow fibre membrane
- model of SkyHydrant
- 500 ml plastic cup
- 100 ml plastic cup
- dry clay

Additionally:
- clear water

Question: How does the SkyHydrant make water safe for drinking?

Simple filtration is not sufficient: as experienced before, cotton cloth is not suitable to clean colored and dirty water. The pores are way too big to hold back the dirt. In this experiment, we first have a look at the membranes and how they filter water (1). In a second step we explore how the Membrane Ultrafiltration system in the SkyHydrant exactly filters the water (2).

(1) How does a membrane filter work?

Description:

Use the single hollow fiber membrane (Water is forced from inside to outside). Fill a 60 ml syringe with turbid water. Connect the syringe with the single hollow fiber membrane and close the membrane at the other end.

Create a decent pressure on the syringe and press the water into the membrane. Oberserve what happens: The water migrates here from inside to outside. Your can see clear water coming out the membrane. Collect the water and compare it to the turbid water you have filled in at the beginning.

Open the other end of the hollow fiber membrane, then the trapped dirt can be rinsed out.

Explanation:

The hollow fiber membrane which is used here has seven channels, into which the dirty water can be pressed. The walls of the hollow fiber membrane include tiny pores (20 nm), which are only permeable for water particles, and dissolved salts. Solids, turbidity, bacteria and viruses are retained at the fibre walls.

(2) How does the SkyHydrant make water safe for drinking?

Description:

Use the membrane ultrafiltration model (Water is forced from outside to inside): The experimental set-up is designed similarly to a SkyHydrant, but consists of four hollow fiber membranes only. First, fill turbid water into the model that contains the membranes. Then put the same turbid water into the 60 ml syringe. Connect the syringe to the model and create a decent pressure with the syringe. Safe water will pour out of the model and can be collected in a beaker. Compare the original turbid water with the clear water in the beaker.

The four hollow fiber membranes are closed at the top and housed in a pressure vessel. Pressing dirty water with a syringe into the container, water particles and dissolved salts migrate through the membrane walls into the channels and further into a container. The water migrates here from the outside to the inside. The soil can be removed by rinsing the pressure container from time to time.

Explanation:

The water passes through the tiny pores which are in the skin of the hollow fibres, but so small that one cannot see them with the naked eye. These pores remove turbidity, solids, bacteria, viruses, protozoa and worms which are too big to pass through the pores. The pressure produced here represents the pressure that is produced at Maji Safi Kiosks

through gravity. Gravity lets the water flow down from the upper water tank through the Skyhydrant into the lower storage tank of the Maji Safi Kiosk set up. The membrane ultrafiltration system in the Skyhydrant can easily filter the water and work without any electricity.

Message:

Membrane ultrafiltration ensures a high quality of water as it removes 99,9 percent of the bacteria, viruses, protozoa as well as solids, turbidity, suspended matter by physical treatment only. No chemicals are added. Dissolved substances like salt, floride or arsen cannot be filtered out.

Topic 2: (Re-) contamination of water

Refer to the discussions the group had last time. Outline again that it is not always possible to judge the grade of water pollution and, in consequence, the contamination of water and food.

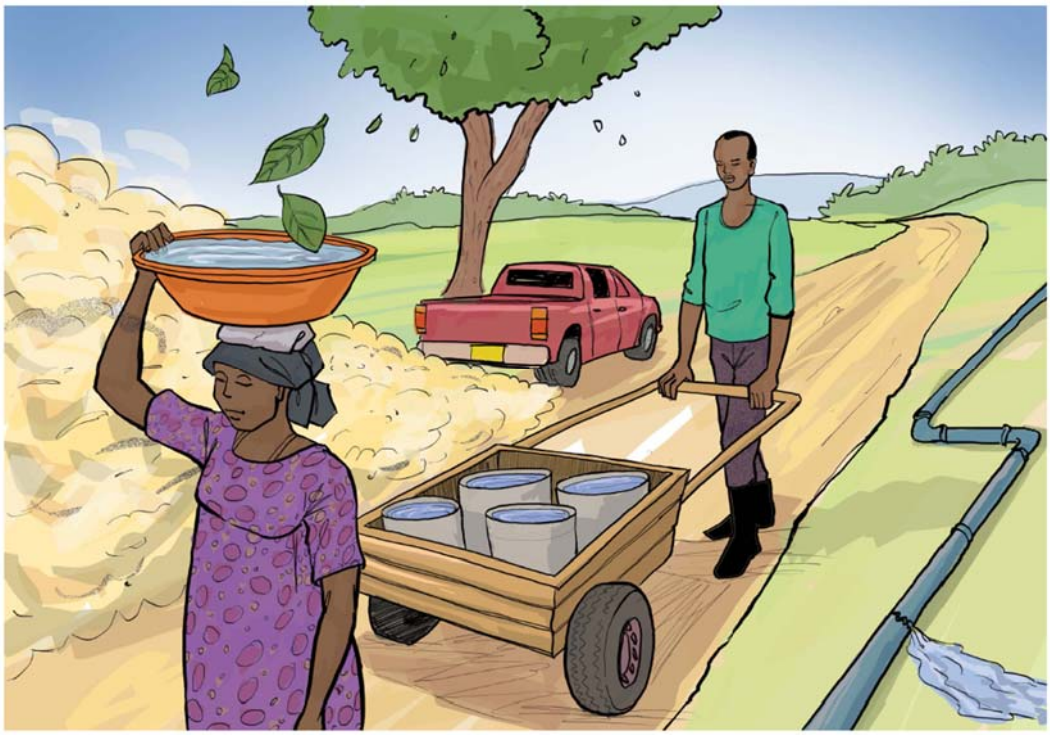
Water pollution and its dangers: There are various ways of water (re-) contamination at source, during transport and storage. You can´t always see whether the water is safe for consumption. To be sure, one either needs to fetch safe water from a safe source (e.g. buy from the Maji Safi Kiosk) and then transport and store it properly, or use raw water and treat it at point of use.

Show the following illustrations (which are included in the illustration manual) to the children and ask them what they observe: What is going wrong in these pictures? What should be done differently? Collect their answers and then provide the information given on water contamination at source, during transport and at storage and use.

Water can be (re-)contaminated quickly – here are a few examples: [xi,xii]

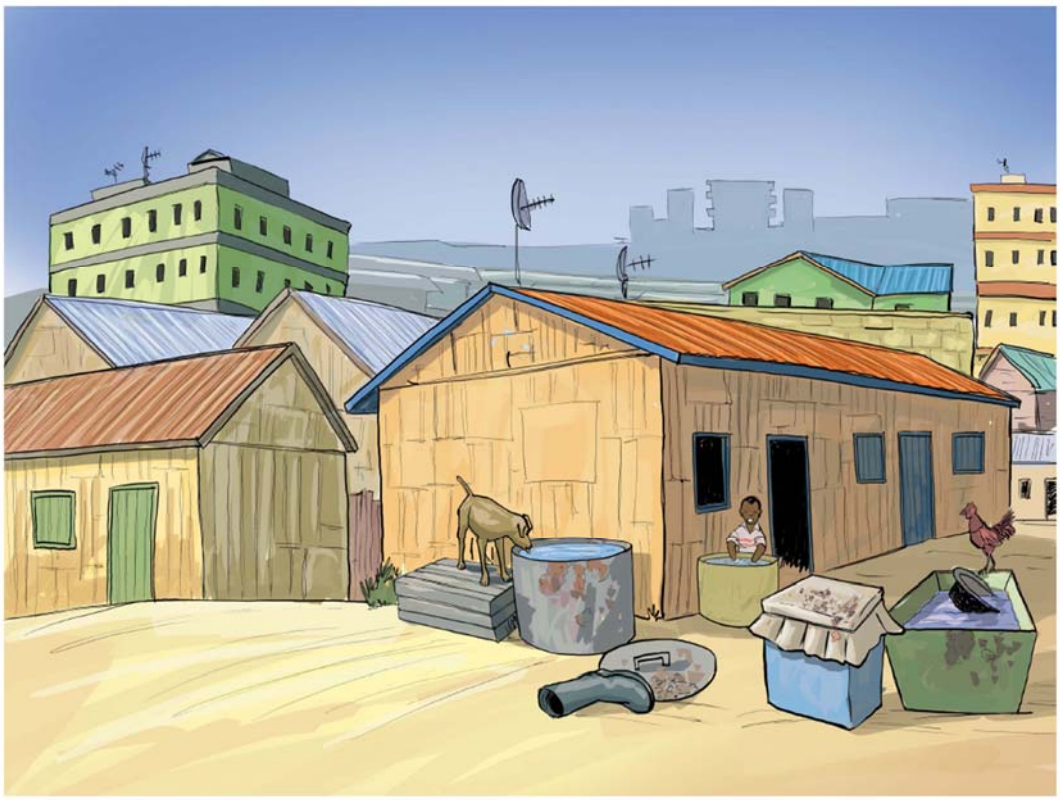
At source

- Use of surface runoff water as a water source – this water might contain germs e.g. herbicides, feaces
- Open defecation / Locating toilets near water sources
- Bathing / swimming in the water source
- Washing clothes and utensils in the water source
- Cleaning motor bikes, bycicles, cars in the water source
- Watering animals at the source
- Dumping of solid waste, e.g. dead animals in the water
- Disposal of sewage and industrial wastes by the water source



During transport

- Transportation vessel is not clean or lockable
- Dust enters the vessel, the container or the water pipe
- Leaves placed in the water
- Dipping of fingers in the water



At storage

- Dirty storage containers
- Hand dipping in water
- Dirty sieving utensils and container covers
- Domestic animals can contaminate water stored in open containers
- Dust and soot which might enter the water storage container if uncovered

At use

- Use of dirty cups or glasses for drinking the water
- Fingers dipping in water
- Use of only one cup or glass for more than one person

How to prevent water (re-) contamination

- Use **clean covered containers** for water collection, transportation and storage
- **Locate latrines away from water sources**, at least 30 meters away
- **Protect the water sources** e.g. through fencing
- Do **not bathe / swim** in water sources
- Do **not wash clothes** and utensils at the water source
- Do **not clean motorbikes**, bycicles or cars in water sources
- Do **not damp waste** in water sources, instead compost or burn it
- **Water animals only in designated sources**
- **Plant trees** around water sources

Activity 7

Case study: Why paying for water?

Albert very much believes in God and runs a boarding school for orphans and disadvantaged children. The school is located in a very remote region in Central Kenya where access to safe water is very limited. Many children suffer from diarrhea and can often not attend school. Albert spends about 200,000 KES per month to cover the costs for medical treatment for his 90 children and wants to cut these costs. So, Albert decides to choose a Maji Safi kiosk as the only supplier of drinking water for the children. At this kiosk, a Membrane Ultrafiltration technology is applied to physically filter the water and to make it safe for drinking. In the months after, he recognizes that the bills for medical treatment dropped from 200,000 KES down to 2,000 KES per month.
What does this story tell us?

Let the children discuss in groups of two and then let them share their assumptions with the class.

Possible answers:

- Consuming safe water keeps people from getting ill
- Consuming safe water saves money otherwise paid on medical treatment
- Consuming safe water is healthy, diarrhea is preventable
- Consuming safe water ensures that people can attend school/university or go to work
- You can make a choice!

Summary of key messages

1. Water can be made safe for drinking through boiling, chlorination, using solar disinfection (SODIS method) or membrane ultrafiltration.
2. Water gets (re-)polluted in many ways: at source, during transport and storage. It is important to keep water and food safe and avoid recontamination through disinfecting containers and keeping containers shut at any time and away from any animals.
3. Consuming safe water saves money and keeps family members in a better health condition.

Lesson 4: Hygiene practices – Personal hygiene

Information for the teacher

References to the syllabus: According to the Kenyan syllabus, Lesson 4 is applicable in class:
Standard 1: Health – Hygiene, Cleaning the body
Standard 2: Health – Cleaning the classroom
Standard 2: Foods – Hygiene and food storage
Standard 3: Health – Health, latrines, urinals
Standard 8: Environment – Soil pollution
Standard 8: Foods and nutrition – Causes of food poisoning

Objectives: This lesson raises the issue of hygiene and explains its different components. It explains how germs spread and how people take up these germs through consuming contaminated food and water. Particular emphasis is put on personal hygiene.

Methodology: Discussion, Experiments, Illustrations

Time required: 1 ½ hours

Material to be provided: Board or flip-chart, pens/markers/chalk
Material for experiments
Illustration manual

Agenda planning

Time	*Topics*
10 minutes	Welcome and recap
25 minutes	Topic 1: Germs transmission Experiment “Passing the germs”
20 minutes	Topic 2: Definition of hygiene Illustration of “F-diagram” including blocks of germs transmission routes
25 minutes	Topic 3: Personal hygiene Experiment “Washing hands”
10 minutes	Summary of key messages

Content preparation

Welcome and recap

Do a brief follow-up discussion round on what you have been discussing last time. In particular, repeat key messages of the previous lessons.

Topic 1: Germs transmission

In previous lessons, we have learned that germs are not visible with the naked eye, but they transmit diseases.

How do people get infected with germs?

Collect the answers and write them visibly on a board or flip-chart.

Possible answers:

- Transmission of germs like worms, faeces, bacteria, viruses …
- Consumption of contaminated, unsafe water
- Touching contaminated mud, soil, dirt
- Transmission through other persons who carry germs by e.g. shaking hands
- Touching animals
- Eating with dirty hands/fingers

All of these answers are right. People get ill because of the ingestion of germs. Germs are transmitted very easily from one person to another and also from objects to persons. Most of the common diseases refer to poor hygiene and/or consumption of contaminated water. To be able to prevent ourselves from getting ill, we need to understand how germs are spread.

Activity 1

Experiment: Passing the germs

Topic: Personal hygiene

Material to be provided:
- flour

or
- UV-creme
- black light torch

Additionally:
- cardboard box

Question: How do germs spread from one person to another or from an object to a person?

Description:

Ask four children to voluntarily help doing the experiment and follow these instructions:

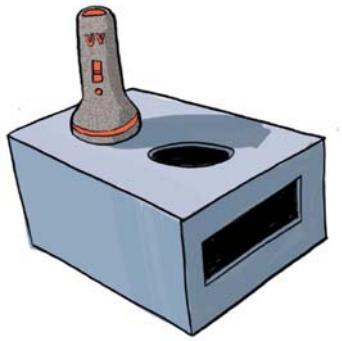
Place a good amount of flour on one of the volunteers' hands. Have that volunteer shake another volunteer's hand and keep repeating around the circle. By the time each volunteer has shaken another's, the flour particles have spread to everyone.

Soon there will be traces of flour particles on objects and the volunteers - books, chairs, pens, door knobs and noses etc. Encourage the children to find all possible spots where the flour particles have spread.

Explanation:

In this experiment flour represents germs, as germs are too small to be seen with the naked eye. It demonstrates how germs are spread from one person to another and from objects to persons. People can track the flour/germs and recognize how easily germs spread and how important it is to take up measures with which to prevent oneself from germs transmission.

Alternative experiment:



Instead of flour you can use a UV dyed hand creme which you distribute by hand shaking. Ask the children to come forward and put their hands through a hole into the box. A “black light bulb” inside the box highlights the traces of the crème, and the participants can observe this effect by looking through a second hole in the box. Thus they will detect the "transmitted germs" clearly on their palms.

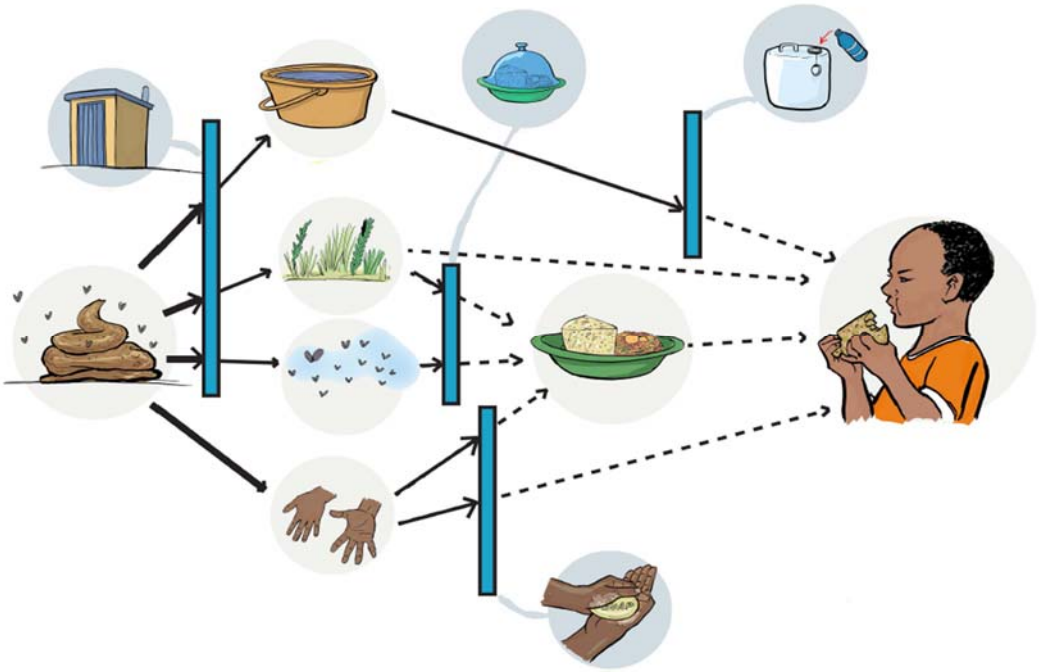
Message:

Germs are transmitted very easily from one person to another and from objects to persons.

Germs are all around us and often harm us or a member of our family. Harmful parasites, bacteria and viruses are in most cases invisible. It´s not only about minor health effects, it´s about serious infections. In many communities people consume each other´s germs in a continuous cycle. Due to open defecation practices, faeces and other germs easily find their way into the water cycle and the food chain. Germs´ transmission routes are too often not blocked.

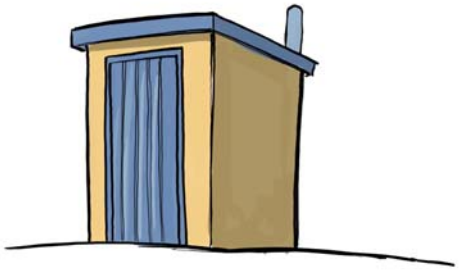
Have a look at the F-diagram again and discuss how transmission paths can be blocked. Then use the following F-diagram including preventive methods and discuss them with the class. Illustrations are provided in the illustration manual.

By practicing good hygiene, we BLOCK the transmission paths of germs as you can see in the following illustration.



Preventive methods:[xiii]

- Proper sanitary disposal by **using latrines** instead of open defecation
- **Covering water vessels** at source, during transport and at storage
- **Applying water treatment** methodologies for drinking, washing utensils, fruits and vegetables
- **Covering food**
- Good personal hygiene, especially through **hand washing,** before preparing food, eating and after defecatio n: Use soap and safe treated water!



Topic 2: Definition of hygiene

What is hygiene exactly?

Collect all answers and write them visibly on the board. Then compare them to the definition given below.

DEFINITION:

Hygiene refers to conditions and practices that help to maintain health and prevent the spread of diseases.[xiv] It includes practices such as washing hands, keeping our bodies clean, handling food properly, treating water before consumption and the like.

Why is hygiene important?

Collect all answers again and provide the following information.

Hygiene is important because:

- Hygiene can stop people becoming ill. Some serious diseases can put people in hospital, even for weeks. In some cases, people can die.
- If you resign hygiene practices you will continuously consume germs like bacteria, viruses, faeces (also from other people) through eating and drinking contaminated food and water. This can make you ill, over and over again.
- Hygienic behavior also avoids spreading illnesses within the community. This means you can also prevent other people from getting ill.
- Proper hygiene practices demonstrate your respect towards yourself and towards others.

What does “good hygiene” exactly mean?

Hygiene includes different parts such as personal hygiene, hygiene at home, at school and in the community.

Topic 3: Personal hygiene

Personal hygiene means to keep bodies, hair, hands, teeth and fingernails as well as clothing clean. Regular bathing or showering with soap makes sure that the body can be properly cleaned. The utensils used such as bath sponges, towels and toothbrushes should not be shared.

Main aspects:
➔ **Keep hands**, teeth, body, hair and fingernails short and **clean**.
➔ Bathe or **shower regularly**.
➔ **Always use soap** or detergent for hand washing and bathing/showering to remove dirt.
➔ Most important hygienic practice: **Wash your hands**!

Activity 2

Experiment: Washing hands

Topic: Personal hygiene

Material to be provided:

- cooking oil
- soap

Additionally:

- water

Question: What happens when you wash your hands?

Description:
Put one drop of olive oil on your hands and try to rinse it off, first with water alone. Secondly, try to rinse it off with water and soap. Observe and describe the difference between the two techniques.

Explanation:

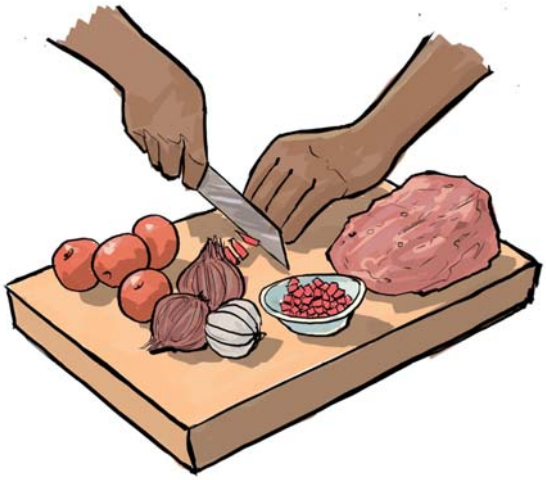
This experiment illustrates the benefits of using soap as a hygienic way to clean the hands.. Micro-organisms stick to the skin. The tenside molecules of the soap encircle the microorganisms so that they can then be washed away with water.

Message:

Washing hands with soap is the most important hygiene practice and crucial for blocking germs´ transmission routes in order to prevent illnesses.

When is it important to wash hands?

Use illustrations provided in the illustration manual and discuss the following situations with the class.



BEFORE eating and preparing food (also BEFORE feeding a child)

BEFORE and AFTER caring for a sick person

AFTER using the latrines or/and changing nappies

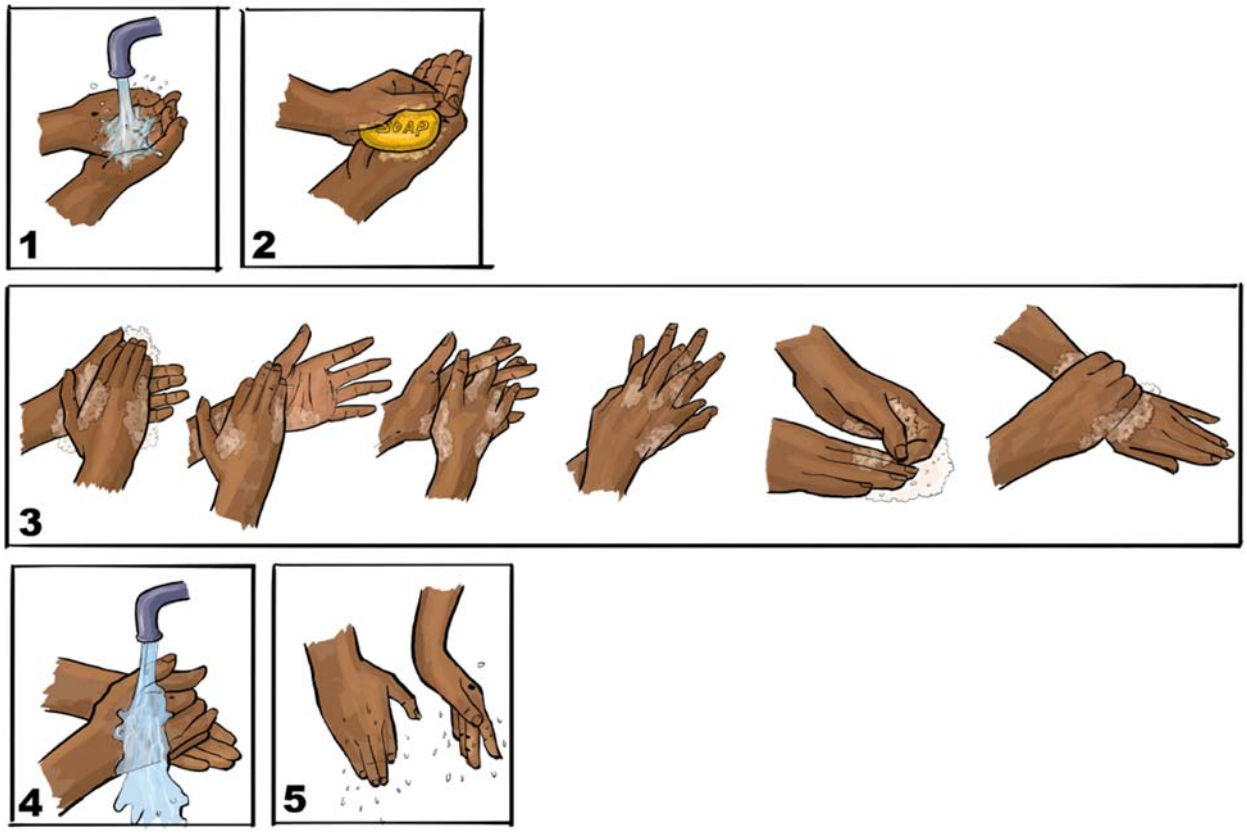
AFTER touching dust, soil and dirt, e.g. after playing outside, and AFTER touching animals

AFTER collecting and/or disposing waste

How shall we wash our hands?

The following five simple steps remove germs from our hands:

1. **Wet your hands** with clean and safe water.
2. **Apply soap** or any other appropriate detergent.
3. **Rub your hands** together for at least 10-15 seconds. Thoroughly wash the wrists, palms, back of hands, between fingers and under the fingernails.
4. **Rinse the hands** with clean and safe running water.
5. **Air-dry your hands** to avoid recontamination.



Summary of key messages

1. Germs are transmitted very easily from one person to another and from objects to persons. Therefore, community hygiene is as important as personal hygiene.
2. Hygiene means to block the germs´ transmission routes in order to prevent illnesses. It refers to practices like washing hands, our bodies, fruits and vegetables, cleaning clothes, beddings and living areas.
3. Proper hand washing means: Using soap, rub whole hands, also between fingers and nails for at least 15 seconds and wash down with safe water.
4. You should wash hands: **Before** handling with food, before eating, before feeding children and **after** defecation, after helping children to defecate and after touching anything suspicious.

Lesson 5: Hygiene practices – Home, School, Community

Information for the teacher

References to the syllabus: According to the Kenyan syllabus, Lesson 5 is applicable in class:
Standard 2: Health – Hygiene
Standard 3: Health – Health, latrines, urinals
Standard 6: Water – Sanitation, hygiene
Standard 7: Environment – Components of the environment
Standard 8: Environment – Soil pollution

Objectives: This lesson explains aspects of hygiene at home, at school and within a community. Besides practicing good personal hygiene, it is also important to keep the surroundings clean. Therefore, information and know-how on waste management is provided.

Methodology: Illustrations, Community mapping, Experiments, Discussion

Time required: 1 ½ hours

Material to be provided: Board or flip-chart, pens/markers/chalk
Material for experiments
Illustration manual

Agenda planning

Time	*Topics*
5 minutes	Welcome and recap
30 minutes	Topic 1: Hygiene at home, at school, within a community Sanitation analysis
45 minutes	Topic 2: Waste management Experiment “A walk to look for garbage” Experiment “Waste separation and avoidance”
10 minutes	Summary of key messages

Content preparation

Welcome and recap.

Welcome children once again and do a brief follow-up discussion round on what you have been discussing last time. Repeat again key messages of the last lesson.

Topic 1: Hygiene at home, at school, within a community

Home hygiene

Home Hygiene refers to the range of activities which the families' need to undertake to protect themselves from infectious diseases. It includes food and water hygiene, handwashing, safe disposal of human and other waste. It also includes infection prevention and control in home healthcare (caring for family members who are infected, or at greater risk of infection).[xv]

Show the children the illustrations of a clean and a cluttered home and discuss the differences. What can be observed here? Can you describe the differences?

Relevant home hygiene components are:

Proper food handling

- ✓ Kitchen utensils which are used to prepare food shall always be washed with safe water and detergent in order to keep them clean.
- ✓ Foods which are eaten raw need to be washed with safe water before consumption.
- ✓ Foods which deteriorate quickly like e.g. milk, eggs, butter, fish or meat, need to be stored in a fridge or another cool place or eaten very soon.
- ✓ All foods need to be covered properly in order to prevent contamination by flies, children hands and dirt.

House cleanliness

- ✓ Floors and furniture shall be wiped regurlarly in order to keep the house clean from dirt and dust
- ✓ All animals and pets shall be kept outside the house to avoid infections from animals to humans

Safe storage of domestic water

- ✓ Dirt accumulates at the bottom of storage containers such as jerricans. Storage containers should therefore be cleaned and disinfected regularly, ideally before every refill. They should also be selected based on the following considerations:
  - Easy to clean i.e. a rounded jerrican is better than a sharp cornered jerrican
  - Water storage containers should be fitted with cover and should be thoroughly cleaned if they were used for other purposes before storing water.

Proper waste disposal

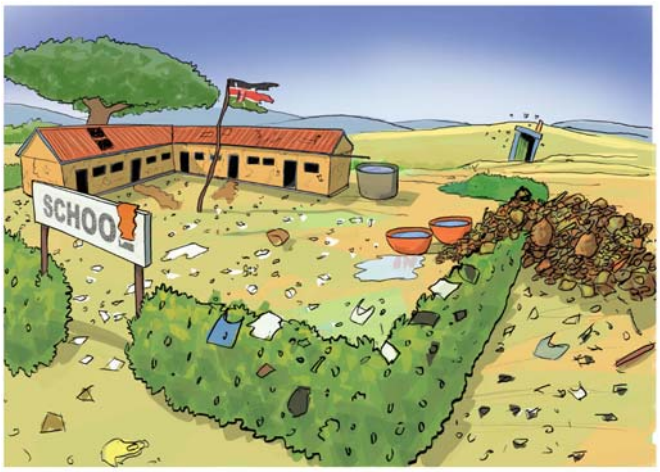
- ✓ using appropriate disposal facilities such as rubbish pit, dustbins and incinerators
- ✓ composting of biodegradable waste
- ✓ proper faecal disposal through the use of latrines/toilets
- ✓ keeping the compound clean by cutting overgrown vegetations and grass
- ✓ fencing of the compound

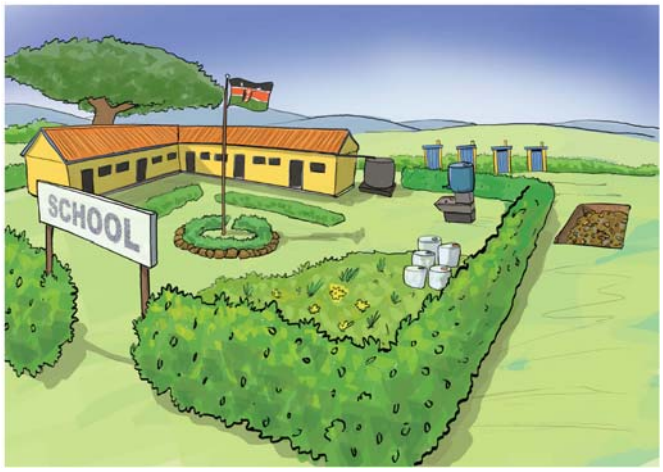
Main aspects:

- ✓ Wash food and cooking utensils with safe water before preparing food and consuming it.
- ✓ Store drinking water in covered containers.
- ✓ Disinfect containers for water storage regurlarly and keep them always covered.
- ✓ Keep the house clean and separate animals from the house.
- ✓ Dispose your waste properly.

School hygiene

Not only at home, also the school facilities and surroundings need to be kept clean. It is a common responsibility which should be shared among the teachers, the pupils, the school committees and the partents. Basically, the aspects of school hygiene are not different to those referring to home hygiene.





Main aspects:

- ✓ Hand washing facilities shall be provided and properly maintained – soap must be available at any time
- ✓ Availability and proper treatment and storage of drinking water
- ✓ People handling with food shall observe proper hygiene practices
- ✓ Classrooms shall be cleaned regurlarly
- ✓ Latrines shall be built and cleaned regurlarly by using detergents
- ✓ Waste shall be disposed properly
- ✓ Vegetation shall be kept short within the compound

Community hygiene

Activity 1

Sanitation analysis

Topic: Sanitation

Material to be provided:
- map of water sources
- pens of different colors

Question: How is the current situation with regard to sanitation in our community?

Description:

Use the community map which the group created in Lesson 2 indicating local landmarks and water sources used in the community. Remember: Mapping means creating a simple map of the community to locate households, resources and problems, and to stimulate discussion. It is a useful tool for getting all children involved and a good visual analysis of the community situation.[xvi]

Again all children should be invited to locate their own households on the map. Encourage children to use different pens and colors. After recapulating the main water sources in the community, ask the children to draw in the sanitation facilities like latrines, open fields and other places on community ground, people normally use.

Then compare the main water sources with the sanitation facilities and areas you have identified. If these areas are located close to each other, faeces can easily enter the water, contaminate it and find their way to human body again.

Explanation:

One source for water contamination is a prevalent: water pollution through open defecation. To avoid water contamination through open defecation, community members shall use latrines which need to be built at least 30 meters from any water source in the community.

Message:

Open defecation endangers the health of the whole community, because germs and faeces can easily enter the water cycle.

Topic 2: Waste management

Hygiene refers to the cleanliness in a community. If you look at the streets and the environment, you often encounter a lot of garbage lying around. Waste is often disposed at public places and can be found at many streets and compounds. Waste comprises different materials: biodegradable waste, plastic, glass, paper etc.

Go through the compound together and map the environmental pollution as described in the following experiment.

Activity 2

Experiment: A walk to look for garbage

Topic: Waste management

Material to be provided: plastic sacks

Question: What sorts of things do we find in our local environment? What should not be there?

Description:

Go for a walk with the children in the local area and look for garbage that has been thrown on the ground heedlessly. Collect any plastic and glass bottles as well as paper that you come across. Ask the children where the garbage could have come from, what materials it consisted of originally or what it was used for. Think about where the garbage really belongs (i.e. it should be collected) and why it is not good for the environment if people simply throw their garbage on the ground.

Set up the experiment. Get the children to place a piece of plastic sack and a piece of leftover fruit or vegetable (weighted down with a stone so that it cannot blow away) in a protected location in the area that is easily accessible. Together with the children observe what happens to the two materials over a longer period. The plastic sack remains, and the fruit or vegetable leftovers change their appearance and structure or are eaten by an animal.

Explanation:

Not everything that is thoughtlessly thrown away in nature rots or is eaten by animals. Everything that is not biologically degradable usually remains around for a very long time, altering nature and even harming it in certain cases.

Message:

Waste on school grounds, on streets and in the environment pollutes soil and water.

Activity 3

Experiment: Waste separation and avoidance

Topic: Waste Management

Material to be provided: large plastic sacks for collecting garbage

Question: How much waste is produced in a week?

Description:

Ask the children what kinds of garbage they know about and where waste is produced. How much waste material do the children think they produce together in a week?

Suggest to the children that they collect all garbage accumulating from now on in the sacks or cartons so that at the end of the week they can see what and how much they have accumulated together. After collecting for a whole week look with the children and see what has been collected. What type of garbage is there? Together with the children separate the plastic, paper, and glass again. What did the children not expect to see as garbage when they originally thought about it? What is the most common type of waste?

Explanation:

Garbage is produced in many everyday situations and needs lots of space. Many waste products are not degradable by natural means, but are at least recyclable, i.e. they can be processed for reuse**.** Garbage which is simply dumped in the countryside pollutes our environment and hence the earth on which we live. Thoughtlessly dumped waste also spoils the appearance and the beauty of a landscape.

A first important step towards environmental protection is therefore a responsible approach to garbage. Separation of garbage and avoidance of waste are really easy and quick to do. Waste that cannot be recycled must be disposed separately. It can either be incinerated or specially stored.

Discussions:

Get the children to think about how they can actively avoid creating garbage and consider possible ways in which they can put this into practice. Discuss with the children what they can do to help prevent water pollution.

Some of the solutions to emphasize include:

- avoiding improper littering
- using toilet facilities
- tell friends and family what they have learned about health and hygiene
- glass can be recycled, also PET bottles (e.g. for SODIS method)
- vegetable or fruit leftovers can be dumped at one defined site on the compound and will rot there. After a certain period of time this “new earth” can be used as a fertilizer.
- Other waste should be collected and burnt as a public service.

Message:

There are different kinds of waste: biodegradable organic waste, glass, metals, paper, solid waste, fluid waste. Some substances are even poisonous and can harm people, animals and the environment. Some substances rot, others can be recycled.

Summary of key messages

1. Hygienic behavior at home, at school and in the community as a whole is crucial to keep children and people stay healthy.
2. Sanitation is often also an issue: Open defecation endangers the health of the whole community, because germs and faeces enter the water cycle.
3. Waste on school grounds and on the streets pollutes soil and water.
4. There are different kinds of waste: biodegradable organic waste, plastic, glass, metals, paper, solid waste, fluid waste. Some substances are even poisonous and harm people, animals and the environment. Some substances rot without harming anything, others can be recycled.

Annex

List of illustrations

Lesson 4 – Topic 1: Germs transmission	The F-diagram – block germs transmission paths
Lesson 4 – Topic 1: Germs transmission	Methods to block transmission routes – apply water treatment
Lesson 4 – Topic 1: Germs transmission	Methods to block transmission routes – cover food
Lesson 4 – Topic 1: Germs transmission	Methods to block transmission routes – use latrines
Lesson 4 – Topic 1: Germs transmission	Methods to block transmission routes – wash your hands
Lesson 4 – Topic 3: Personal hygiene	When to wash hands – before eating
Lesson 4 – Topic 3: Personal hygiene	When to wash hands – before preparing food
Lesson 4 – Topic 3: Personal hygiene	When to wash hands – before and after caring for a sick person
Lesson 4 – Topic 3: Personal hygiene	When to wash hands – after using the latrine or changing nappies
Lesson 4 – Topic 3: Personal hygiene	When to wash hands – after touching dust, soil and dirt – after playing outside
Lesson 4 – Topic 3: Personal hygiene	When to wash hands – after touching animals
Lesson 4 – Topic 3: Personal hygiene	When to wash hands – after collecting or disposing waste
Lesson 4 – Topic 3: Personal hygiene	How to wash hands
Lesson 5 – Topic 1: Home hygiene	Cluttered home
Lesson 5 – Topic 1: Home hygiene	Clean home
Lesson 5 – Topic 1: School hygiene	Cluttered school
Lesson 5 – Topic 1: School hygiene	Clean school
Lesson 5 – Topic 1: Community hygiene	Clean community

List of experiments

Module / Lesson	**Experiment / Activity**	**Material (provided in the kit)**	**Additional Material**
Lesson 1 – Topic 1: Water is life	Water is limited and a precious resource	500 ml plastic cup table spoon 100 ml plastic cup 1 ml syringe *Optional*: small piece of aluminum foil	clear water
Lesson 1 – Topic 1: Water is life	Water cycle in a bag	zip-plastic bag marker pens of different colors	soil clear water small branch of tree or buch with leaves
Lesson 1 – Topic 1: Water is life	Water cycle in a bag – Part II	zip-plastic bag marker pens of different colors food colorant	clear water
Lesson 1 – Topic 1: Water is life	Water cycle hand and finger game	500 ml plastic cup Illustration of water cycle	
Lesson 1 – Topic 2: Water pollution	Water dissolves pollutants	100 ml plastic cup (2x) cardboard aluminium foil table spoon table salt food colorant	clear water
Lesson 1 – Topic 2: Water pollution	Water as a solvent	100 ml plastic cup kitchen paper towel water soluable black fiber pen	clear water
Lesson 2 – Topic 1: Water sources and usage	Mapping of water sources	big sheets of paper pens of different colors illustrations of water sources	

Lesson 2 – Topic 2: Clear and safe water	Making pollution visible	100 ml plastic cup (2x) candle (2x) table spoons (2x) table salt matches	safe water
Lesson 2 – Topic 3: Waterborne diseases	When plants drink	100 ml plastic cup kitchen paper towel scissors food colorant	clear water
Lesson 3 – Topic 1: Water purification	Compare different samples of water	100 ml plastic cup (2x) black marker pen sheet of paper	water samples from different sources in the community safe water
Lesson 3 – Topic 1: Water purification	Water filtration by means of a paper	500 ml plastic cup (2x) kitchen paper towel	turbid water samples
Lesson 3 – Topic 1: Water purification	Case study – Why boiling sometimes fails		
Lesson 3 – Topic 1: Water purification	How the SODIS method works	½ litre PET bottle (2x) hibiscus tea	clear water
Lesson 3 – Topic 1: Water purification	Effects of chlorinating water	100 ml plastic cup (2x) hibiscus tea sodium hypochlorite solution (e.g. WaterGuard)	clear water
Lesson 3 – Topic 1: Water purification	How Membrane Ultrafiltration works	500 ml plastic cup 100 ml plastic cup single hollow fibre membrane model of SkyHydrant dry clay	clear water
Lesson 3 – Topic 2: (Re-) contamination of water	Case study: Why paying for water?		
Lesson 4 – Topic 1: Germs transmission	Passing the germs	flour *Optional*: UV crème blacklight torch	cardboard box

Lesson 4 – Topic 3: Personal hygiene	Washing hands	cooking oil soap	water
Lesson 5 – Topic 1: Community hygiene	Sanitation analysis	map of water sources pens of different colors	
Lesson 5 – Topic 2: Waste management	A walk to look for garbage	plastic bag or sack	
Lesson 5 – Topic 2: Waste management	Waste separation and avoidance	plastic bag or sack	

List of material

Material	Quantity	Experiment / Activity
Plastic cups 500 ml	25	Water is limited and a precious resource Water cycle hand and finger game Water filtration by means of a paper How Membrane Ultrafiltration works
Plastic cups 100 ml	25	Water is limited and a precious resource Water dissolves pollutants Water as a solvent Making pollution visible When plants drink Compare different samples of water How membrane ultrafiltration works Effects of chlorinating water
Scissors	3	When plants drink Water as a solvent
Matches	1	Making pollution visible
Syringes 1 ml	10	Water is limited and a precious resource
Dry clay	1	How Membrane Ultrafiltration works
Food colorant	1	Water cycle in a bag – Part II Water dissolves pollutants When plants drink
Black pen, waterproof	1	Water cycle in a bag Water cycle in a bag – Part II Community mapping – Water sources Compare different damples of water Community mapping – sanitation analysis
Red pen, waterproof	1	Water cycle in a bag Water cycle in a bag – Part II Community mapping – Water sources Community mapping – sanitation analysis

Blue pen, waterproof	1	Water cycle in a bag Water cycle in a bag – Part II Community mapping – Water sources Community mapping – sanitation analysis
Pelikan black pen, water soluble	5	Water as a solvent
Stabilo black pen, water soluble	5	Water as a solvent
Zip plastic bags (20 x 25 cm)	25	Water cycle in a bag Water cycle in a bag – Part II
Table spoons	6	Water is a limited and precious resource Water dissolves pollutants Making pollution visible
Table salt	1	Water dissolves pollutants Water as a solvent Making pollution visible
Candles	20	Making pollution visible
Aluminum foil	1	Water is limited and a precious resource Water dissolves pollutants Water as a solvent
Kitchen paper towels	2	Water as a solvent When plants drink Water filtration by means of a paper
Sheets of white paper	4	Compare different samples of water Community mapping – water sources Community mapping – sanitation analysis
Hibiscus tea	1	How the SODIS method works Effects of chlorinating water
½ litre PET bottles, colorless	2	How the SODIS method works
WaterGuard	1	Effects of chlorinating water
Single hollow fibre membrane	1	How Membrane Ultrafiltration works
Model of SkyHydrant	1	How Membrane Ultrafiltration works

Flour 500 g	1	Passing the germs
UV-Crème	1	Passing the germs
Black light torch	1	Passing the germs
Cooking Oil	1	Hand washing
Soap	36	Hand washing
Large plastic sacks	5	A walk o look for garbage Waste separation and avoidance

References

Footnotes:

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[xvi] Kar, K. (2000): *Practical Guide to Triggering Community-Led Total Sanitation (CLTS)*. Bangladesh.

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