PRIMARY + STEM

Teaching Resource

ACTIVITY:

Soap or Hand Sanitiser

ACTIVITY OVERVIEW

How does something we cannot see grind the world to a halt? Before COVID-19, this situation would have been unimaginable. Learning about what viruses are and how they function will certainly go a long way in helping us understand what we have had to do and keep doing in response to keeping our bodies healthy, and to protect our families and friends.

Washing hands with soap - how to wash and how long to wash for - and using hand sanitisers have become routine for most students. But how does one method compare to the other? In this hand hygiene-based activity, students compare the effectiveness of soap and hand sanitisers.

SYNOPSIS

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Foundation – Year 2

- Living things have a variety of external features and live in different places where their basic needs, including food, water and shelter, are met. (VCSSU042)

Year 3 – 4

- Living things can be grouped on the basis of observable features and can be distinguished from non-living things. (VCSSU057)

Year 5 - 6

- Living things have structural features and adaptations that help them to survive in their environment. (VCSSU074)
- Plan and practise strategies to promote health, safety and wellbeing (VCHPEP108)
- Investigate the role of preventive health in promoting and maintaining health, safety and wellbeing for individuals and their communities (VCHPEP112)

ACTIVITY, MATERIALS AND INSTRUCTIONS

ACTIVITY

Washing hands with soap - how to wash with it and how long to wash for - and using hand sanitisers, have become routine for most students. But how does one method compare to the other?

Students will prepare four slices of bread by touching them with differently washed hands (soap, sanitiser, unwashed and control), then monitor growth of microbes over one week.

Microbes (organisms that have individuals that can only be seen with the help of a microscope) that students will be able to see are either bacteria or fungi.

Viruses, although more numerous than bacteria, are too small to be seen even with microscopes.

Materials

For students working in groups of four or five

- 4 slices of white bread (DO NOT touch slices of bread before activity)
- 4 sandwich bags
- Spray bottle filled with water
- Paper towels/plates (to place the white bread on)
- 1 black marker
- 1 pair of gloves
- Hand soap
- Hand sanitiser
- Access to sink
- Poster: Wash your hands-poster-English.pdf (dhhs.vic.gov.au)
- Poster: clean_hands_alcohol.pdf (health.gov.au)

Per class of 30 students:

- 1 bag of sliced white bread (DO NOT touch slices of bread before activity)
- 1 box of sandwich bags
- Spray bottles filled with water
- Paper towels
- Black markers
- Disposable gloves
- Hand soap
- Hand sanitiser
- Access to sink
- Poster: Wash your hands-poster-English.pdf (dhhs.vic.gov.au)
- Poster: clean_hands_alcohol.pdf (health.gov.au)

Instructions

1. Students work in groups of four or five.

2. Determine as a class how to conduct a fair test when comparing whether there are any differences between using soap, hand sanitiser, or even whether there is a point in washing hands in the first place.

What is our objective? What do we want to test/compare?

To compare the differences between what we do to our hands and the type of microbes that are found on them.

What is the one thing that is different between our experiments?

The treatment that our hands get - i.e. soap, hand sanitiser, or unwashed

What do we keep the same? All other factors, e.g. type of bread, making sure all parts of the hands are cleaned with soap or sanitiser, amount of water added to bread.

3. Teacher or students to label the bags the following:

a. Control
b. Soap
c. Hand sanitiser
d. Unwashed

4. Teacher issues four slices of bread to each group on a paper towel or paper plate.

Handle the bread with gloves to keep it as 'sterile' as possible.

Students should not touch the bread at this point with their bare hands. It will contaminate the bread.

3. Assign each student in the group one of the following bags:

a. Control experiment
   Wear and use gloves.
   Spray one slice of bread with water five times. It should be damp.
   Place the piece of bread in the sandwich bag labelled 'Control'.
   Seal the bag.

b. Soap
   Wash hands for 20 seconds with soap, making sure that all parts of hands are washed.
   Wipe one slice of bread all over hands.
   Spray the bread with water five times. It should be damp.
   Place bread in the sandwich bag labelled 'Soap'.
   Seal the bag.

c. Hand sanitiser
   Rub a 20-cent size amount of hand sanitiser all over hands, making sure all parts of the hands have been covered.
   Wipe one slice of bread all over hands.
   Spray the bread with water five times. It should be damp.
   Place bread in the sandwich bag labelled 'Hand sanitiser'.
   Seal the bag.

d. Unwashed
   Wipe hands over frequently touched surfaces in your classroom/ playground (e.g. furnishings, playground equipment, computer keyboard). Wipe one slice of bread all over hands.
   Spray the bread with water five times. It should be damp.
   Place bread in the sandwich bag labelled 'Unwashed'.
   Seal the bag.

4. Pack up and wash hands.

5. Place all bags in a cool place and record any changes every day over the seven days.

- **Do NOT unseal the bags at any point.**
- **Do NOT keep the bags in the classroom for longer than 1 week.**
- **Dispose of bags in landfill as soon as experiment is completed.**

6. Discuss.

- What are some predictions?
- Why do we need to spray water onto the bread? Living things need food, water, and air to grow.
- What is the purpose of the control experiment? To use as comparison against the other hand treatments.

- What are some flaws in this experiment which could affect the results?
- What would students do differently the next time?

E.g. Not handling the bread slices properly before the experiment, e.g. teacher not wearing gloves/washing hands. The bread ought to be as untouched as possible for it to only grow bacteria found on students' hands.

E.g. Not washing hands properly, comparing hands of different students.

Observations and Results

Students will see varying amounts of microbial growth in their experiments. Under ideal conditions, it should be greatest in number on the unwashed hands, and least on the control.

The following outcomes could occur:

a. Poor growth in all bags

   It could be that there isn't enough water for microbes to grow. Ensure that this doesn't not happen by spraying the bread with sufficient water to make it damp. Or, the bread could have added preservatives that inhibit microbial growth.

b. There appears to be different colours of microbes on bread

   Generally, different colours correspond to a different type of bacteria/fungus.

HOW TO USE THIS ACTIVITY WITH YOUR STUDENTS

Foundation - Year 2

All living needs things require food, air and water. Even very small living things like bacteria. As an extension to this activity, students could set up another experiment with the same materials as the main activity to explore whether water is important for making microbes like bacteria grow.

Students repeat this experiment except without spraying water onto the bread. What differences do students expect to see?

There should be less bacterial growth on the dry bread compared to the damp bread.

Years 3/4

Living things come in different sizes. Some, like bacteria and yeast, are only made up of one cell. Others, like humans, are made up of many cells. In fact, an average human is made up of more than 30 trillion cells! Besides being made of cells, all living things have the following in common:

a. They have instructions in their cells, i.e. DNA, RNA
b. They need food, air, and water
c. They can do things including move, make energy, respond to their environments, growing, make babies, make waste, feed.

Challenge students to research the microscopic world of the bacteria and protist kingdoms to find some very fascinating organisms. Students could identify and research their chosen microbe, illustrate it on an A4-

piece of paper, and give it features of a superhero. They also list three special qualities/behaviour based on their findings. How about voting on a microbe to be the class mascot for the term?

For bacteria:

10 Types Of Bacteria With Real Superpowers - Listverse

Ranking the Top 10 Best Bacteria on Earth (inverse.com)

For protists:

Protists Facts for Kids (All You Need to Know!) - CoolaBoo - Education Site

Suggested protists to research: diatoms, amoeba, paramecium, radiolarians

Years 5/6

There are many questions that would springboard from the main activity. This represents a great opportunity for students to collaborate to find answers to their questions. Using materials from the activity, students set up their own experiments to answer their own questions/objectives, e.g.

1. Does washing hands for different lengths of time really matter?
2. Do all brands/types, e.g. organic, baby, sensitive. of hand soap work the same way?
3. Is white bread the best for growing bacteria?
4. Would this experiment also work on slices of potatoes?
5. How much water is best for growing bacteria?

Whatever further experiments are conducted, please always follow this safety advice:

Do NOT unseal the bags at any point.

Do NOT keep the bags in the classroom for longer than one week.

Dispose of bags in landfill as soon as the experiment is completed.

DISCUSSION SECTION AND KEY THEMES

This is not the first time the world has encountered a new virus, and it will certainly not be the last. We share this amazing planet with so many other organisms and this is part and parcel of negotiating our space within it.

To appreciate what a virus is, we must first understand what characteristics all living things share. This is because what a virus is has a lot to do with what it isn't and how it is different from other living things.

Living things:

a. are made up of cells
b. have instructions inside the cells in the form of DNA/RNA
c. need food, air, and water
d. can do the following things (often known by the acronym MRS GREN):
   - move
   - respire (use oxygen to get energy out of the food they eat)
   - sense (respond to changes)
   - grow
   - reproduce
   - excrete (get rid of waste)
   - nutrition (feed or make food)

Living things in our planet are grouped according to their similarities in their cell structure, and how they do things. The science of grouping living things by their similarities is called taxonomy. One way of categorising them is to divide them into five kingdoms – animal, plant, fungi, bacteria, and protist.

Animal Kingdom

Members of this kingdom move freely, and feed on other living things, e.g. hunting, gathering, growing.

Plant Kingdom

Members do not move like animals do, and they are able to make food from light through photosynthesis. Without plants, there would not be life on earth as we know it today.

Fungi Kingdom

Living things that feed off dead things belong to this kingdom. In ecosystems, we depend on them as decomposers. Mushrooms are members of the kingdom we can see because they are made up of many cells – multicellular. But there are also many that we cannot see, such as yeast, because they are unicellular. We've learnt to use fungi in our daily lives, e.g. in cheeses, soy sauce, and wine.

Bacteria Kingdom

All members are unicellular so we can only see these with the aid of microscopes. Bacteria are the most abundant in number of all living things, and they come in many different shapes. Not only are we surrounded by them – we have bacteria covering our skin and intestines - but it turns out we need them. In fact, we take probiotics, which are bacteria, on the understanding that we need them to maintain our immune system and keep our brains happy. We've learnt to use bacteria to ferment foods, such as cheese, wine, chocolate, yoghurt, vinegar, and sauerkraut. We even need bacteria to make paper!

Protist Kingdom

Like the spare kitchen drawer where we store items that do not have a natural place anywhere else in the home, this particular kingdom is home to living things that do not fit nicely into the other kingdoms. Members include pondwater life, like paramecium and amoeba, beautiful and delicate diatoms, and seaweed.

Viruses

Are they living things or not?

This is a subject that is continually debated. Some scientists define viruses as living things, others disagree, while some say viruses are neither living nor non-living. Viruses do not do all the things that living things do - not all the time anyway. They do not move, do not grow, and they do not need food, air, or water. But like all living things, they have instructions in the form of DNA/RNA and they are good at replicating (making copies of themselves)... but only when they are inside another living thing, using the other living thing as a factory.

Virus Facts

a. Structure and shape
   Viruses are very simple compared to all other living things. That's because they don't need to do very much. They contain instructions (either DNA or RNA), a protein coat, and maybe a fatty envelope like the coronavirus. They also come in a few common shapes – the coronavirus which causes COVID-19 is spherical with an outer covering (envelope).

b. Size and abundance
   10 to 100 times smaller than bacteria. They are by far the most abundant biological agents – there are up to 4 times more viruses in sea water than bacteria.

c. How it multiplies (replicates)
   On the surface of the SARS-CoV2 are spike proteins which allows

it to attach to certain cells of our body. These are generally cells found within the lungs, heart, brain, and intestines; which explains why symptoms of an COVID-19 infection are also expressed in these organs.
Once the virus has attached itself to a cell, it proceeds to inject its DNA/RNA into the human cell and hijack its machinery to make new virus particles. Each of these newly made viruses then go on to infect other healthy cells.

d. Uses of viruses
Research is being done with bacteriophages (viruses that infect bacteria) to help us combat antibiotic-resistant bacteria (superbugs). Countries in Eastern Europe have been doing this for a long time.

QUESTIONS AND ANSWERS

1. What is the COVID virus?

COVID-19 is the disease brought about by a type of virus called a coronavirus. The name of the specific coronavirus is the SARS-CoV2. There is still much to learn about the SARS-CoV2 virus.

2. If we are surrounded by bacteria and viruses, then why aren't we sick all the time?

A healthy immune system keeps sicknesses away by getting rid of the bacteria and viruses quickly. In our blood, we have white blood cells which defend us against these pathogens.

We keep our immune system healthy by sleeping well, eating well, and exercising regularly. Vaccination plays an important role in keeping our immune system updated with the latest pathogen, such as the SARS-CoV2, so that our white blood cells can be well-prepared.

3. How does washing our hands get rid of germs like viruses?

Washing our hands with soap works because the outer envelope of the coronavirus is made of something 'oily'. And, like using detergent to remove oil from dinner plates, soap works to remove the oily parts of the envelope. When the envelope is disassembled, the virus is destroyed.

A similar principle applies to using hand sanitisers that contain at least 60% alcohol.

4. So which is better – soap and water, or hand sanitiser?

The World Health Organisation (WHO) recommends using hand sanitisers only as an alternative when we don't have access to soap and water. Hand sanitisers may not be as effective as soap at killing certain bacteria and viruses like Cryptosporidium (causes diarrhoea) and norovirus (stomach flu).

One of the reasons why hand sanitiser is not as effective is because people often stop wiping their hands before the hand sanitiser dries completely. Also, the alcohol doesn't penetrate through dirt and grease on our hands as well as soap can.

5. How do viruses make me sick?

We experience disease when there are enough viruses in our body that infect and prevent our cells from carrying out their normal functions. Different diseases are accompanied by different symptoms, e.g. diabetes causes incontrollable blood sugar levels, and heart diseases could stop the heart from beating properly. However, the reason why we FEEL sick is a little more complicated than that.

During an infection, our bodies create an inflammatory response to fight the virus. Symptoms like fever, runny noses and phlegm, are actually part of our defence against the virus.

The reason for this response is that it brings specialised immune cells to the site of infection to make antibodies against the virus, destroy infected cells, and build a memory of the virus for the next encounter.

However, if our bodies are not able to properly manage the response and it goes out of control, we end up requiring intensive care at the hospital.

6. I've had COVID-19 but why wasn't it as bad as I thought it would be?

Data from all over the world show that children experience the lowest rates of COVID-19 infection. Primary school-age children make up a small percentage of reported cases in Australia. More importantly, children who are infected with the virus have less severe cases of COVID-19 than adults.

It could be due to the differences in the way a child's and an adult's immune system respond to the presence of the virus. Or it could be that some strains of the virus are not as deadly as previous forms. Or it could be due to the high rates of vaccination. There is still much to be learnt about this disease.

7. Surely it's a good idea to get rid of as many germs as possible with strong chemicals and medications because they make us sick?

While it may be instinctive to eliminate bacteria, fungi, and viruses altogether, it is best to accept that we live in partnership with all living things - including 'germs'.

While some of them make us sick, like the SARS-CoV2 virus, there are many other germs that are good for us. For example, the bacteria living on our skin and in our intestines. We need them to help defend us against other less friendly 'germs'. We are also only beginning to learn how bacteria in

our intestines affect our moods and immune systems. There is so much more to learn about this world we share with all living things.

8. Where is the germiest place in the house?

A large study was conducted in 2011 to find the answer to this question. Many people had guessed that it would be the bathroom, but the study revealed it was the kitchen sink!

Researchers looked for the bacteria Salmonella and E. coli because they make people ill, and they indicate the presence of poo (whether from animals or humans). And guess what? They found them on more than 75% of all dish sponges and 45% of kitchen sinks!

9. Do doctors prescribe antibiotics for COVID-19 (and other viruses)?

Antibiotics only work against bacteria. Since COVID-19 is brought about by a virus, antibiotics will be ineffective against it. Drugs that are used to kill viruses are called antiviral medications. These drugs work in various ways - including destroying parts of the viral DNA/RNA, interfering with the virus' ability to bind to human cells, and stopping newly made viruses from leaving the cell.

Antiviral medications do not replace the need for vaccination in healthy people. With vaccination and sufficient rest, most people's immune systems will get rid of the virus without suffering extreme symptoms.

10. How does vaccination work?

Our immune systems remember every pathogen, e.g. bacteria, fungi, virus that has infected us before. And because special immune cells in our body have memory of what they look like, we can defend ourselves against the same pathogen a lot quicker the next time. This often helps us avoid infections altogether.

Vaccinations are important for introducing our special immune cells to a pathogen we have never come across before. That way, our immune systems will know what to do in case it enters our body. Through vaccination, diseases like smallpox have been eradicated; while other infectious diseases, including polio, measles, mumps and rubella have been mostly eliminated.

OUTSIDE OR SUPPLEMENTARY READING

Protecting ourselves from COVID-19

Protect yourself and others from COVID-19 | Australian Government Department of Health

Coronavirus

What is coronavirus? | Facts for kids - National Geographic Kids (natgeokids.com)

Soap or hand sanitiser?

Hand sanitiser or soap: making an informed choice for COVID-19 - Curious (science.org.au)

The dirtiest place in the house

Germiest Items in the Home | NSF International

How does the immune system respond to COVID-19?

Cytokine storm in COVID-19: from viral infection to immune responses, diagnosis and therapy - PMC (nih.gov)

How children respond to COVID-19

COVID-19 and Kids: What you need to know | CHQ (health.qld.gov.au)

How many cells make up the human being?

There are 37.2 Trillion Cells in Your Body | Smithsonian Magazine

TOPIC WORDS

- Virus
- Infection
- Disease
- Handwashing
- Kingdom
- Living
- Non-living
- Move
- Make energy
- Respond
- Make wastes
- Grow
- Reproduce
- Feed
- Microbe
- Bacteria

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