

Teacher Notes- “Viruses And Variables”

In this activity each student is given a test tube with what appears to be water and told to exchange solutions with each other. What they don't know is that all but one of the test tubes is distilled water, and the other one is salt water.

The activity is done twice to give us a chance to change one variable the second time through. That means this an excellent activity to use during a chapter on health, or at the beginning of the year when talking about variables.

Materials:

Test tubes-enough for 2 per student
Test tube racks
Salt

[Silver nitrate](#) (item # WW98098M00 at [sciencekit.com](#)); later this will be our indicator

Dropper/pipet

Small beaker (50 mL)

Large beaker (500 mL)

Distilled water (1 gallon); do *not* substitute tap water

Additional Teacher Materials:

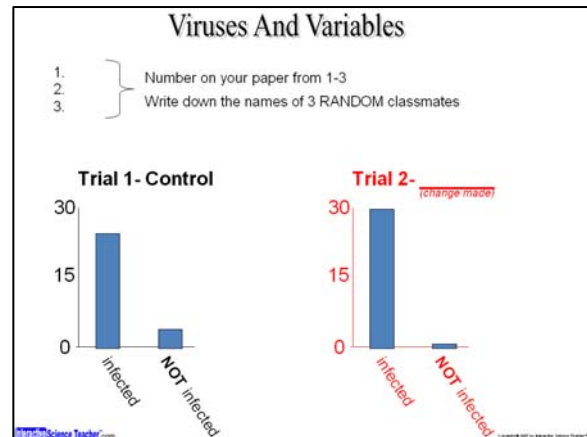
PowerPoint and Student Handout (see last page)

Beforehand: (Do the following *the day before*)

If you are fortunate enough to have lots of test tubes (more than 100), you'll want to pre-pour them. This is a job you can delegate out to your students the day before, which they would love. First have them wash the test tubes with hot, soapy water if they're not clean. When they're mostly dry, have them fill each test tube about 1/3 full of distilled water. Since each student needs 2 test tubes, the more of these you can pre-pour, the better off you are. Do not substitute tap water for distilled- tap will give a false positive reading.

Make the salt water solution and silver nitrate solution-

- ◆ Pour some distilled water into a 50 mL beaker, add some table salt, and stir. Give it time to settle so the salt water you pour off the top and into test tubes will be as clear as the test tubes with distilled water. Pour 2 salt water test tubes (1/3 full, just like the rest) for each class.
- ◆ For the silver nitrate solution, fill a 500 mL beaker with distilled water. Add a little (1/4 of a gram) silver nitrate crystals and stir. Put a masking tape label on all your beakers so you remember what's what.



***CAUTION:** *always wear goggles and gloves when handling silver nitrate. If you or students come in contact with it, immediately wash.*

As with any other activity, try your solutions out the day before so you **KNOW** they work. Get a dropper/pipet and put a few drops of your silver nitrate solution into a test tube with distilled water. It should stay clear. If it doesn't, most likely your test tubes are dirty, and the residue caused them to cloud. Wash the dirty test tubes (again) with hot soapy water.

Now test your "infected" test tube- take a test tube with salt water and mix it with a distilled test tube and then pour some back in so the solutions are about equal. Mix that one with another distilled tube. Then put a couple of drops of silver nitrate solution into each tube you just used. They should all turn cloudy white. If not, you either need to add a little more silver nitrate to the big beaker or a little more salt to the little one.

Set up two sets of test tube racks before each class comes in (remember-you're doing this activity twice) so that all but one of the test tubes have distilled water, with one salt water test tube in each set. This is the one that will "infect" the rest.

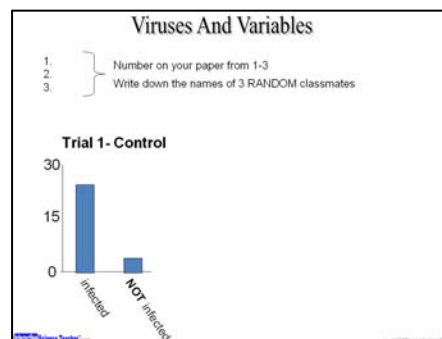
Procedure:

1. Give students the handout (see last page) or have them take out piece of paper and open their books to the current section you're covering.
2. Give a brief introduction to viruses- what they are, how your body fights them/defends against them. When talking about pathogens my favorite topic is white blood cells. Since most states require you to talk about HIV and AIDS, this is a perfect time to hit that topic again briefly. You can also cover a page or two in your book while you have the opportunity.

PART I- Trial 1

3. Explain slowly and clearly what we are doing- everyone gets 1 test tube. They will trade solutions with 3 other students. After that we're in for a little surprise.
4. Demonstrate so students see how to exchange- pick up 2 test tubes (make sure they both have distilled in them!) and pour one tube completely into the other, and then the second one now back into the first so they're both about even.
5. Have students number from 1-3 on a piece of paper (already printed on the handout). Ask what the word "random" means. They need to keep this in mind when they write down the names of 3 random classmates. Tell them to imagine rolling a 30-sided die (which are out there, by the way), each side with the name of a classmate, and they roll it 3 times. Write the names of those 3 random classmates next to the numbers. They are *not* to write the names of any of their friends.
6. Give students their test tubes. Tell them that although each looks like harmless water, never assume it is.
7. Since they know who they're trading with, and how to trade, let them to go ahead and do the exchanging, and sit down after they've traded 3 times. Tell them you expect this to take about 3 minutes. (It will take longer, but in this activity you don't have much time to waste, so do what you can to keep them moving and on track.)

8. After they've traded 3 times and everyone is seated, tell them it's time to reveal the surprise- one of the test tubes at the beginning had a "virus". And since we've all traded solutions 3 times, what do you think has happened? It's time to find out. (This would be a great time to make a prediction.)
9. Take your silver nitrate solution around the room (wearing goggles and gloves) and put 2-3 drops into each test tube. Tubes that turn cloudy are "infected". Tubes that stay clear are not infected.
10. Time for a short discussion. What just happened? How did we go from one infected tube to most of us being infected? Pick out a random student, one with a clear tube and clearly not infected to avoid any humiliation- "Of our 30 original test tubes, let's say he was the original one that was infected. Now, he's clear right now, so we know he wasn't. but for the sake of our discussion, let's say he was. How many people did he trade with? (3). So... first there's him, and then he switched with 3 other people. Why aren't there just 4 people infected? Why are so many of us infected?" Continue the discussion, making points you feel are important.
11. While doing this discussion, pick up the test tubes, or have a student go around with a rack and pick them up for you while you talk. Keep them separate from un-used test tubes.
12. If you're short on test tubes, you'll need to pour them all out and rinse them with tap water (preferably hot), shake them out, and refill with distilled for the next trial. Get student help if you're doing this.
13. Make a bar graph that shows your results with 2 bars- how many were infected, and how many were not. Title it: "Trial 1- Control". Change the y-axis numbers on the bar graph on the PowerPoint as needed.

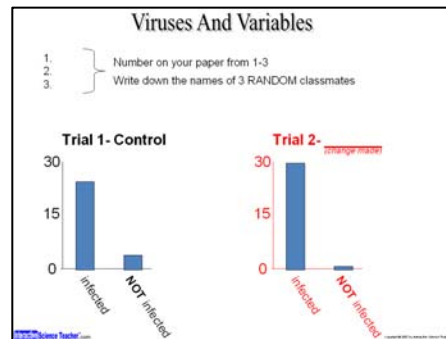


PART II- Trial 2

14. Now for some rich application to science. On their paper, have students write the prompt "**Variables**".
15. Announce that we're going to re-do this activity, but with one change. Quickly go back over how the activity went, and ask students what kinds of things we can change the second time through. Let them come up as many as they can before you add:
 - a. The number of "infected" tubes we started with
 - b. Who you trade with- instead of being random, this time students decide. Or, if students chose the 3 they switched with the first time, have them choose 3 different people this time
 - c. The number of people to trade solutions with
 - d. The option to switch test tubes with other people before any trading occurs. This may or may not affect the *number* of people infected, but it certainly will affect *who* is infected.
 - e. Offer a "quarantine"- you have the option of going and standing in the corner and not trading with anyone while everyone else does.

- f. How solutions are exchanged: ex.-they pour a little of their solution into someone else's, but that person does not pour back into theirs.
- g. Make them aware at the beginning, before trading, who the original "infected" person is, and then see who still trades with that person.
- h. _____ (other idea)
- i. _____ (other idea)

16. Let students pick which one of those variables to change. Ask why is it important that we just change 1 variable at a time, and not 2 or 3? (We want to be able to compare results from our first trial with the second. Any difference between them is attributed to that one change. If more than 1 variable changes, you don't know which is responsible for the change in numbers, and that is bad science because your results are useless).
17. Hand out a fresh set of test tubes and let them trade solutions, adjusting for the variable.
18. Check test tubes with the silver nitrate indicator.
19. Discuss your results. How was this different than trial 1?
20. Make another bar graph next to the first. Title it- "Trial 2: (variable changed)"
21. Time-permitting, have students write down a few things they learned. (Viruses spread fast, wash our hands, change only 1 variable at a time, etc..)



There are many variations on this activity you may have seen. I've tried others, but this method using salt water with silver nitrate is the best because it is easiest and most reliable.

Another method: for the indicator indicator, dissolve some baking soda into 500 mL of distilled water (the exact amount is not important as long as there is baking soda in the water). Prepare the solution for the "infected" test tube: dissolve a tiny bit of phenolphthalein in a small beaker of isopropyl alcohol. Keep the amount minimal- too much and when switched with other test tubes they will show cloudiness even before indicator (your baking soda water) is added. Another problem is that the "infected" test tube smells like isopropyl alcohol and all the others don't, which is a dead giveaway. So just before the activity smear isopropyl across the tops of ALL test tubes so they all smell like it. After students switch solutions, you come around and add the baking soda indicator. Those that are "infected" will turn pink.


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PowerPoint- lead your students through the lesson click-by-click

Viruses And Variables

1. }
2. } Number on your paper from 1-3
3. } Write down the names of 3 RANDOM classmates

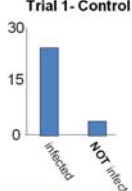
Trial 1- Control



Viruses And Variables

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Trial 1- Control

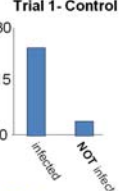


Category	Count
infected	25
NOT infected	5

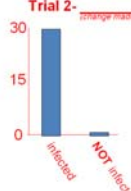
Viruses And Variables

1. }
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Trial 1- Control



Trial 2- experimental




Category	Count
infected	25
NOT infected	5

Student Handout

Viruses And Variables

1.
2.
3.



Variables:

- 1.
- 2.
- 3.
- 4.