Zombie Apocalypse – How Disease Spreads through a Population

TEACHER NOTES

Science Objectives

- Students will investigate the spread of a disease through a population, using zombies as a model.
- Students will learn or review the basic functions of various parts of the human brain.
- Students will investigate and discuss factors dealing with immunity and vaccines.

Vocabulary

- Epidemiologist
- Cerebellum
- Hypothalamus
- Frontal Lobe
- Amygdala
- Infection
- Vaccine
- Virus
- Virulence

About the Lesson

- This lesson introduces the concept of a disease spreading through a human population using fictional zombies as the agent of infection.
- Teaching time: one 45 minute class period
- As a result, students will:
  - Interpret graphs to make predictions.
  - Use simulations to understand the symptoms of a fictional disease and see how the disease moves through a population.

TI-Nspire™ Navigator™

- Send out the *Zombie_Apocalypse.tns* file.
- Monitor student progress using Class Capture.
- Use Live Presenter to spotlight student answers.

Activity Materials

- Compatible TI Technologies: TI- Nspire™ CX Handhelds, TI-Nspire™ Apps for iPad®, TI-Nspire™ Software

Tech Tips:

- This activity includes screen captures taken from the TI-Nspire CX handheld. It is also appropriate for use with the TI-Nspire family of products including TI-Nspire software and TI-Nspire App. Slight variations to these directions may be required if using other technologies besides the handheld.
- Watch for additional Tech Tips throughout the activity for the specific technology you are using.
- Access free tutorials at http://education.ti.com/calculators/pd/US/Online-Learning/Tutorials

Lesson Files:

Student Activity

- Zombie_Apocalypse_Student.pdf

TI-Nspire document

- Zombie_Apocalypse.tns

Background

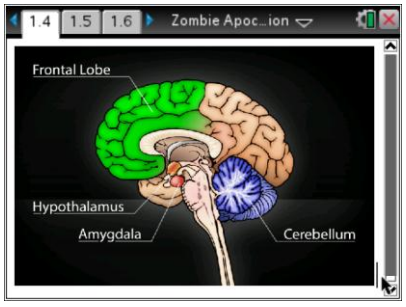
There are highly stylized images of zombies in this file. If you have students who have concerns with this activity, you may choose to delete the page with the zombie images. Explain to students that although zombies do NOT exist, they serve as a fun, pop cultural model that allows us to talk about disease and the spread of disease. Many television shows and movies have zombies as a part of the storyline, so they will serve as a way to engage students as they are introduced to the concepts of disease and the patterns and parameters that are characteristic of the spread of disease.

This particular activity starts by giving students the scenario of a virus spreading through a population. It goes on to describe the symptoms of the infection and wraps up with an animated simulation of the disease spreading through a population demonstrating an associated graph generating a characteristic 's' curve.

It is likely that students will question the mechanism of transmission. This activity depicts the zombie virus being transmitted through airborne saliva droplets from coughing and/or sneezing. Movies and television programs have treated the zombie "infection" in different ways. Students will ask if zombies get infected from bites from other zombies. Those kinds of questions are great opportunities to discuss how the spread of the disease would be different from the airborne model this activity portrays.

Move to pages 1.2 - 1.5.

1. Students will read the above scenario whereby a newly discovered virus has been infecting humans, causing them to exhibit zombie-like symptoms. There are four areas of the brain which the virus affects –



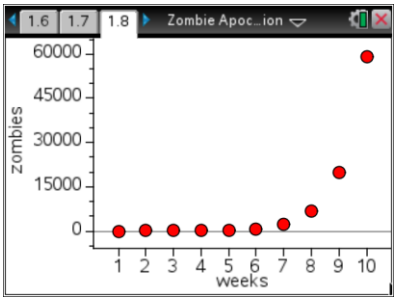
   - The Cerebellum: Balance and Coordination
   - The Hypothalamus: Appetite
   - The Frontal Lobe: Intelligence and Problem Solving
   - The Amygdala: Anger and Rage

The Resulting Symptoms

- **Affected Cerebellum**: Zombies clumsily shuffle forward.
- **Affected Hypothalamus**: Zombies have insatiable appetites.
- **Affected Frontal Lobe**: Zombies are poor problem solvers.

- **Affected Amygdala**: Zombies aren't nice. They are full of rage.

Move to pages 1.6 – 1.8.



2. Page 1.8 uses a Data & Statistics page, which students may use to see the rates of infection in the first months after the onset of the disease. Notice this graph appears to have an exponential pattern. Ask students how long they believe this pattern will continue. What factors will affect the pattern?
3. Have students go through the next few pages and answer questions, predicting what will happen next as the zombie virus spreads

Move to pages 1.9 – 1.12. Answer the following questions here or in the .tns file.

Q1. The greatest rate of infection occurred between week _____ and week _____.

Answer: Between week 9 and week 10.

Q2. What is the approximate infection rate between week 1 and week 6?

Answer: Relatively low; the graph makes it looks like zero, but it is actually 300-400 per week.

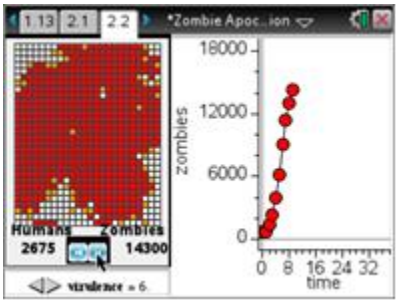
Q3. Take another look at the graph and predict what the number of zombies will be after the 25th week.

Answer: This is hard to determine from the graph, however a reasonable answer would be well into the millions—if the exponential model continued to hold true.

Q4. Explain what you believe will be happening with the rate of zombie production after 30 weeks.

Answer: The rate should slow considerably because of fewer people available to infect.

Move to pages 2.1 – 2.3.



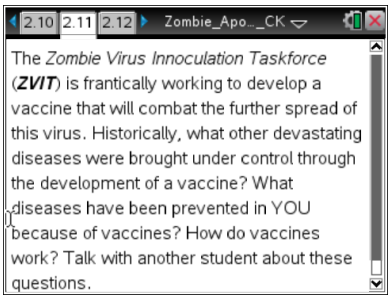
4. Pages 2.1 to 2.3 introduce students to the idea that the zombification rate is limited by certain factors such as food source, virulence (the measure of how effectively a disease-causing agent can spread through a population) and natural resistance to the virus in some humans. Students will use a simulation which offers a visual of the spread of the zombie virus. An associated graph is produced alongside the simulation. The following page, 2.3, shows the inverse relationship between humans and zombies as the disease

progresses through the population. Ask students to discuss other factors that could affect the limitations of a disease and why the relationship between the numbers of humans and zombies is inverse. Discuss why the virus doesn't wipe out all humans in the simulation (natural resistance and low susceptibility).

Tech Tip: Students should select the button to reset the simulation and run it again with a different virulence.

Move to pages 2.4 – 2.12.

5. Students will answer questions about the simulation and the impact of the adjustments they made to the level of virulence. Students should notice that as virulence increases the rate of infection increases until there are no longer susceptible humans to infect. Ask students why some humans become infected with the virus and some do not. There is natural immunity to viruses and bacteria. Biodiversity serves as a mechanism to ensure the survival of a species. This includes resistance to disease.



Q5. In the graph, "time" is the independent variable, but there is no actual UNIT of time indicated. What do you think would be an appropriate unit of time for the spread of the Zombie Virus?

Answer: Weeks or months would be a good answer.

Q6. Estimate the point at which the number of zombies and the number of humans are equal? What variable would affect this point?

Answer: With the virulence set at 2, the numbers of each would be equal at 6-7 weeks.

Q7. Based on the graph of humans and zombies from the previous page, which do you think is the relationship between the two populations?

A. Inverse

B. Direct

C. There appears to be no relationship

Q8. What effect did changing the virulence have on the rate of Zombie Virus infection?

A. As virulence increased, the rate decreased

B. As virulence increased, the rate increased

C. As virulence increased, the rate did not change

Q9. Although the Zombie Virus isn't a real concern for us YET, name another disease that you think has a pretty high degree of virulence.

Answers: Diseases such as influenza, common cold, chicken pox, etc.

Q10. What if a new "strain" of the Zombie Virus appeared that was almost the same as the original virus, except that it did not affect the cerebellum? Predict what the result would be.

Answer: The zombies would have more muscle coordination and may be able to better catch their prey!

Q11. What if the virus changed again, and neither cerebellum nor the frontal lobe were affected? Predict the results.

Answer: Now, in addition to being more physically coordinated, they would also be able to think and reason much more clearly. Not a good scenario for the 'non-zombied' humans!

TI-Nspire Navigator Opportunities

Make a student the Live Presenter to demonstrate their zombie population simulation graphs.

Wrap Up

Students will have various results depending upon the virulence setting they used. Have students compare their graphs and discuss why the results are different.

Assessment

- Students will answer questions throughout the lesson to ensure understanding of the process of disease spread.