

Title: How utilizing Team Based Learning encourage students to utilize study habits and improve the test scores of students who have been taught about the spread of the different types of bacteria at their school.

Zonnelle Hanley

Health Science Academy Educator

FAMUDRS

West Orange Avenue

Tallahassee FL

Abstract: The purpose of this research is to observe how implementing TBL along with an extended lab will encourage students to utilize study skills thus help the students to improve their test scores. Also the question is asked did they even learn anything at all or even retain the information that was taught, the results of a test reflects if this has taken place as well. The method of approach to observe the findings is to teach an extended lab lesson on the spread of bacteria in a school setting and use this to help students learn the specific name of different types bacteria as well as the diseases caused by the particular bacteria that has been identified. The students will utilize the Team Based Learning Method via pre and post testing to see if it will encourage the students to retain, review, study and improve the test scores of the information that they have learned on this particular topic. A survey on study skills and test taking skills will also be given to the students to qualify their approach to testing before and after the lesson and Team Based Learning.

Rationale: One of the things that I have noticed time after time is some of our students' poor performance on tests. Some of our student approach test with anxiety, hopelessness and feeling unprepared. Even after failing or doing poorly on a test some students continue to repeat the cycle even after teaching learning styles and studying techniques of not studying to improve their assessment score.

Students have shown and also confess that they do not study for upcoming assessments. At first I had to ask myself if it is because they do not know how to study, so studying techniques such as utilizing online flash cards, having the actual slides sent to the students, study guides, Kahoot students will not study or review information on their own. It is as if they want to learn by osmosis or would want to use their study guide or notes or textbook.

Intervention: The lesson will cover how bacteria thrive on and can spread due to contact with those surfaces and other human beings and eventually lead to different types of diseases if certain precautions are not taken and awareness through lessons like these.

The content will be covered through reading lessons (utilizing concept mapping) of journal articles or even magazine articles. Students will be lectured on bacteria and disease to get an explanatory background on the different types of bacteria and their link to disease. The students will swab different surfaces in their classroom and around their school building. Surfaces such as door handles, toilet seats, under their shoes, computer key boards, cell phone screens, hands of classmates etc. The students will then apply their swabs to agar and then allow them to grow. Students will observe as well as take notes on the results and observation of colonies of bacterial growth before isolating via inoculation of the colonies to be regrown on agar gel. After isolating the colonies the students will observe the structure of the specific bacteria found in the different areas and be taught about the disease that the particular type of bacteria and how to identify them through Gram staining and the defense mechanism needed to treat such diseases. The student will also be able to test to see how effective commercial agents such as Lysol, hand sanitizers, basic hand washing, rubbing alcohol are with preventing the spread of such diseases.

Data collection and analysis:

Pre and Post testing utilizing the Team Based Learning approach will be used to see If the students were able to learn, retain and apply the information is the lesson learned, thus measuring the improvement of their test scores. A survey on their best practices for studying would also be given to help see students approach to studying as well as taking tests.

Connections to CATALySES Summer Institute: Ideas,Card games

Literature Cited:

Permissions:

LESSON PLAN FORMAT

TITLE: WHAT BACTERIA IS IN YOUR AREA

KEY QUESTION: What type of bacteria are found in the different locations of you, your class room and school.

The laboratory exercises are organized in a thematic fashion and proceed in order to answer key organizing questions:

- What are microbes?
- Where can bacteria be found?
- How can we inhibit bacterial growth?
- What do bacteria need to grow?
- How can we tell one bacterium from another?
- Why do microbes cause disease?
- How are microbes beneficial?

SCIENCE SUBJECT: ANATOMY AND PHYSIOLOGY

SCIENCE CONCEPTS:

Unit One: Microbial Life

Exploration I. What Are Microbes?

Investigation 1. Use of the Light Microscope

Investigation 2. Microscopic Measurement

Exploration II. Where Can Bacteria Be Found?

Investigation 3. Collection of Microbes from the School Environment

Investigation 4. Aseptic Technique

Investigation 5. Streak Plate Method of Isolating Bacteria

Investigation 6. Staining Techniques

Investigation 7. The Gram Stain

Investigation 8. Bacterial Morphology

Exploration III. How Can We Inhibit Bacterial Growth?

Investigation 9. Can Your Hands and Lab Table Be Sterilized?

Investigation 10. Aseptics vs. Disinfectants

Investigation 11. What Are Antibiotics?

GRADE AND ABILITY LEVEL: 9-12 Regular

OVERALL TIME ESTIMATE: 4 weeks

LEARNING STYLES: Visual, auditory, kinesthetic

VOCABULARY: septic, aseptic, (known bacteria

Bacteria - the smallest living organisms.

Bacilli - rod-shaped bacteria.

Cocci - round-shaped bacteria.

Spirilli - spiral-shaped bacteria.

Staphylo - prefix for clumps of bacteria.

Strepto - prefix for chains of bacteria.

Pathogenic - disease causing carriers-individuals who transport a bacteria but do not get sick from it.

Nonpathogenic - not disease causing.

Exogenous - bacteria that enter the body.

Fomites - inanimate objects.

Endogenous - bacteria found in the body. Infection-disease caused by the multiplying of bacteria.

Abscess - walled off inflammation resulting in dead tissue.

Inflammation - swelling that is due to puss and fluids surrounded by a walled off clot.

Puss - white blood cells.

Subcutaneous - below the skin.

Toxigenic - bacteria that produce toxin.

Toxin - poison

Intoxication - illness that results from ingesting preformed toxins

Agar - nutrient media that allows organisms to grow on it but does not break down due to the organism's metabolic processes.

Flame the loop - heating an inoculating loop to kill any bacteria present on it.

Heat fixing a slide - heating a microscope slide to make bacteria stick to the slide.

Gram stain - procedure used to stain bacteria so that they can be seen under a microscope.

Gram positive bacteria - bacteria that stain blue.

Gram negative bacteria - bacteria that stain pink.

LESSON SUMMARY:

STUDENT LEARNING OBJECTIVE WITH STANDARDS:

Standards:

Objectives:

Students should be able to:

- Explain the basic concepts of microbial infectious diseases including their transmission, treatment, and prevention. Grow a bacterial culture of *Staphylococcus aureus*.
- Perform the Gram Staining procedure and then look at the bacteria they have grown using the oil emersion lens on a microscope.

- Count the number of bacteria they have grown and use this data to extrapolate the number of bacteria growing in their body.
- Develop a raw data table of the number of bacteria present in each member of their class.
- Calculate the mean number of bacteria present in their class.
- Graph the number of bacteria present in their class.

MATERIALS:

- 1 individually wrapped sterile cotton swab
- 1 pair of latex gloves
- 1 Mannitol salt agar plate
- 3 or 4 paper towels
- 1 glass slide
- 1 Bunsen burner
- 1 inoculating loop
- tap water

The following stains (crystal violet, Gram decolorizer, Gram iodine, and safranin O) come in 250 milliliter bottles. It is ideal to have one set of stains per group; but if funding is limited, two sets will serve a class of twenty-five

- Crystal violet, Gram decolorizer, Gram iodine, safranin O.
- A microscope with an oil emersion lens is needed to see bacteria. The more microscopes the better.
- A bottle of emersion oil (mineral oil works).
- 1 refrigerator to keep the agar plates in before the lab.
- 1 autoclave or 10% bleach/water solution for disposal of the agar plates that have grown bacteria.
- 1 incubator.

BACKGROUND INFORMATION

ADVANCE PREPARATION:

PROCEDURE:

Use "Reading Rainbow Episode on Germs" to formulate discussion on topic.

LAB PROCEDURE

STEP 1

1A. Using a new sterile cotton swab, collect specimens from human skin.

1B. To collect samples from dry surfaces, simply rub the swab on the surface. Sweaty surfaces (such as arm pits) work the best. Areas that are particularly clean (especially if they have been recently washed with antimicrobial soap) do not work well. Rub hard enough to get a good sample but do not rub so hard that you injure the subject. Bacteria are so small you will not see anything on the swab, but the bacteria is present.

STEP 2

Rub the cotton swab on the collection sight and then run the swab over the top one-fourth of the Mannitol salt agar petri dish. See Figure 1.

DISPOSAL

Used swabs need to be decontaminated by either autoclaving them or placing them in a 10% bleach/water solution. The decontaminated swabs should then be placed in a separate trash bag and incinerated.

1. Light the Bunsen burner. "Flame the loop" by placing the loop part of the inoculating loop in the Bunsen burner flame until the loop turns red.

This kills all bacteria that may be on the loop. Place the loop in a piece of bacteria-free agar to cool it. "Streak" the Mannitol salt agar plate. To streak the plate, using the flamed loop smear some of the sample at about a 90 degree angle from the swabbed area. Streak back and forth until about one-fourth of the plate is covered. See Figure 1. At a 90 degree angle from this streaked area, streak another one-fourth of the plate. See Figure 1. The goal of this is to spread out the sample so that the bacteria are not touching. Therefore when they grow, they will form isolated colonies. Reflame the loop so that you leave it clean.

2. Place the streaked agar plates in an incubator at 37 degrees C for 24 hours.

STEP 3

1. Bacteria will be visible 24 hours later. The Mannitol salt agar should have mostly *Staphylococcus aureus* growing on it. *Staphylococcus aureus* ferments the Mannitol and therefore is a yellow color. *Staphylococcus epidermidis* does not ferment the mannitol and therefore is red.

Copy and distribute Table 1 to the students.

Look at your plates and determine if fermentation has taken place. Record your results in table 1.

The next thing you will need to do to confirm you have grown *Staphylococcus* is the Gram stain. *Staphylococcus* are Gram positive cocci in clusters. Gram positive bacteria stain blue and Gram negative bacteria stain pink. Perform the Gram stain as follows and record your results in table 1.

The dyes used in this procedure will stain your clothes. Wear appropriate attire. Wearing latex gloves during the staining part of this procedure will prevent your hands from turning colors.

2a. Light the Bunsen burner. "Flame the inoculating loop" by placing the loop in the Bunsen burner flame. This kills all bacteria that may be on the loop. Place the loop in a piece of bacteria-free agar to cool it then gently touch the loop to some of the bacteria that has fermented the Mannitol.

Remember this is a yellow color. Get a little on the loop.

2b. Put a drop of water on a clean slide. Smear the bacteria into the water and spread it around until it is evenly distributed.

2c. "Heat fix" the slide. This process attaches the bacteria to the slide. Hold the slide with your fingers and pass it back and forth through the Bunsen burner flame until the slide is completely dry. It should never get hotter than what you can comfortably hold. If it does you have cooked the bacteria and they can't be seen. Heat fix the slide until it is dry.

2d. Hold the slide on an angle over the sink and drop several drops of crystal violet on the bacteria. Allow this to set for one minute.

2e. Run enough tap water over the slide to wash the crystal violet off. Do not scrub.

2f. Hold the slide on an angle over the sink and drop several drops of Gram's iodine on the bacteria. Allow this to set for one minute.

2g. Run enough tap water over the slide to wash the Gram's iodine off. Do not scrub.

2h. Hold the slide on an angle over the sink and drop no more than five drops of Gram decolorizer (isopropyl alcohol works) on the bacteria. Go to step 2i immediately or all the stain will be removed -

you will have messed up. All of your bacteria will be pink.

2i. Run enough tap water over the slide to wash the Gram decolorizer off. Do not scrub.

2j. Hold the slide on an angle over the sink and drop several drops of Safranin O on the bacteria. Do not scrub.

2k. Run enough tap water over the slide to get the excess Safranin O off. Do not scrub.

2l. Blot the slide dry with a clean paper towel.

2m. Place a drop of immersion oil on the bacteria and place the slide under the oil immersion lens of the microscope.

2n. Focus. If you have little blue dots in clumps, you are looking at *Staphylococcus aureus*.

Health professionals determine the amount of bacteria in your body by using a procedure similar to the one you used in table 1. How much bacteria in this case *Staphylococcus aureus* is in your body? This exercise is at best a guess. Count the number of bacteria on the slide. Measure the length and the width of the slide. Multiply length times width. This gives you the surface area of the slide. Write this number down with the number of bacteria present. Measure how tall you are and call this number "h." Measure one-half of your body width and call this number "r." Plug these numbers into the formula for calculating the surface area of a cylinder. The formula is $(2)(\pi)(r)(h) + (2)(\pi)(r^2) = \text{your surface area}$. Take this number and divide by the surface area of the slide. Finally multiply this number times the number of the bacteria on the slide. The number should be huge (billions, trillions or greater). This gives you an approximation of how many *Staphylococcus aureus* bacteria are on your skin. Make sure all of your measuring units are the same.

2o. Clean up. Wash the slides and your hands with an antimicrobial soap.

DISPOSAL -- Used petri dishes need to be decontaminated by either autoclaving them or placing them in a 10% bleach/water solution. The decontaminated petri dishes should then be placed in a separate trash bag and incinerated.

Make a raw data table on the chalk board. Have each class member fill in how many *Staphylococcus* bacteria are present on their skin. Upon completion of the raw data table, have the students calculate the mean number of bacteria present. Use of scientific notation will be a benefit. Finally have the students graph the data. Discuss what the graphs look like and interpret the results.

AND DISCUSSION QUESTIONS WITH TIME ESTIMATES

ASSESSMENT SUGGESTIONS:

EXTENSIONS: