

Ewww, A Mouthful of Microbes!

The Use of Microbial and Molecular Techniques to Identify the Bacteria in Your Mouth.

CATALySES Summer 2017 Action Research Proposal

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Abstract

High school students have very little knowledge of infectious agents, nor their relatedness to the human disease process. Basic molecular and microbiology techniques offer an exciting hands-on approach to introducing this subject. With personalized medicine slowly making its way into our health care, genomic sequencing is required learning if we want our underserved students to be market competitive. This lab uses these techniques to introduce and reinforce molecular and microbiology techniques.

Students will follow this lab over several days. Students will use the techniques in this lab to culture the bacteria in their mouth, grow them on media, make observations of their oral microflora grown, extract that DNA, amplify that DNA, look at the DNA, sequence the DNA, and identify the bacteria grown.

Rationale

I teach biotechnology and biology at Blanche Ely High School, a medical magnet school in Pompano Beach, FL. It is a Title 1 school where 89% of our students are on free or reduced lunch. The population that I teach is in an urban setting, where many students do not even have clean clothing to wear. The winter months are especially challenging as many students show up in shorts and flip-flops; in 70 degree weather. I chose the lab exercise "A Mouthful of Microbes" because my biotechnology lab is lacking a number of basic equipment items necessary to implement a functional high school biotechnology lab. Biotechnology requires students to be exposed to technology used at the University level, often times this becomes a limiting factor to their education and their market competitiveness. The summer 2017 CATALyST program offered a solution to this problem with their Locker program.

Students at the high school level want to be involved in real problems and want a sense of purpose when solving problems. I believe that they get disillusioned with the usual lab experiments or with none at all. Science is a testable entity that must be handled and manipulated by the students in order for them to have purpose. That purpose means so much more when it is relatable to current events, the data is real, and the lab work involves actual techniques and technology that scientists really use on the job.

My action plan is to entwine current event articles and short videos into all of my lessons. The idea is to switch from a direct instruction to an interactive direct instruction/Project based learning. Stalling (1981) found in his research that students learn more when new information is presented by the instructor to a smaller group of students. They learn best when students read out loud, receive feedback, ask questions and receive responses. The articles and videos will be of biomedical interest and current events. The purpose is to "hook" the student's attention, and give them a sense of "Wow, this is important to me". I hypothesize that by including current event articles and short videos there will be an increase in student

engagement, excitement for science, and in problem solving skills. In fact , Stallings, Cory, Fairweather, and Needles (1978) found that teachers that assisted secondary students reading at the first to fourth-grade level have gained up to two reading grade levels in only one school year!

Interventions

I will be implementing the lab exercise A Mouthful of Microbes! and will be measuring the degree of interest that students have in science in the beginning of the year, and then directly after this lab exercise with surveys. I will be in contact with Julie on how to properly set up and how to write questions for the students. I will be measuring student's engagement with concept maps focusing on the levels of complexity that students scaffold as they make connections between words. I will also collect data from pre and posttests accompanying the labs.

Last year I taught using a PowerPoint method and have collected data on posttests. This year all of my biotechnology classes will be taught using an interactive/project based learning. They will receive short videos and current events articles tied to standards and to objectives with the hopes of "hooking" my student's interests. The project based learning will be accomplished by means of the lab, which is to identify the normal flora of the human mouth.

Videos will be sourced from hhmi BioInteractive and TED-Ed, while articles will be taken from NPR, hhmi BioInteractive, and <http://www.scienceintheclassroom.org>.

Data Collection and Analysis

Data will be collected with pre and post tests and compared to 2016/2017 student data. I will be measuring student's engagement with concept maps focusing on the levels of complexity that students scaffold as they make connections between words. This will also be implemented using a pre and post assessment having students complete a mind-map before the activity and then after the activity using a different colored pen each time.

Connection to CATALySES 2017 summer institute

The lesson A Mouthful of Microbes! will be implemented into my Biotechnology 1 Honors class. I will be using the locker program. This will be implemented during the fall 2017 term after the summer 2017 institute.

Literature Cited

Stallings, J., R. Cory, J Fairweather, and M. Needles. "A Study of Basic Reading Skills Taught in Secondary Schools." *Menlo Park, Calif.: SRI International.*(1978).

Evertson, C., L. Anderson, and J. Brophy. "Texas junior high school study: final report of process-outcomes relationships." *Research and Development Center for Teacher Education, University of Texas at Austin.*1.46061 (1978).

Stein, Rob, and Alison Brusek. "What's In His Kiss? 80 Million Bacteria." *What's In His Kiss? 80 Million Bacteria*. NPR, 17 Nov. 2017. Web. 23 June 2017.

Ravella, Shilpa. "How the food you eat affects your gut - Shilpa Ravella." *Ted-Ed*. N.p., 23 Mar. 2017. Web. 25 July 2017. <<https://ed.ted.com/lessons/how-the-food-you-eat-affects-your-gut-shilpa-ravella#review>>.

Permissions

This section will be updated as permissions are requested.

Teacher Name: Alejandro Krause Class: Biotechnology 1 Industry Cert(s): Biotechnology Assistant School: Blanche Ely High School

Standards Targeted:

LAFS.910.RST.2.5, LAFS.9.10.RST.1.3

Strategies To Use: “Multistep Procedures Look-For”

Employability Skills¹ Addressed: Interpersonal Skills; Communication Skills, Critical Thinking Skills, Communication Skills; Information Use; Systems Thinking

Tier 3 Terms

Growth media

Media

Agar

Petri plates

Slants

Deep tubes

Disk-diffusion or Kirby-Bau

Aseptic Technique

contamination

Project Goals:

- Students will be able to make microbiology media.
- Students will be able to use Aseptic Technique to Transfer Bacteria.
- Student will be able to identify gram positive and gram negative bacteria.
- Students will build an infographic to present findings.

Description of Project:

Students are placed into several Biosafety level 1 groups. Students are assigned the task of identifying the unknown microorganism that has infected their patient. Students will be given an unknown vial containing the microorganism that has infected their patient. Students will identify the safety precautions needed during this lab. Students will begin the project by making their media found on the “Making Microbiology Media Protocol.” Students will pour media for petri plates and slanted tubes aseptically. Students will read passage “Use Aseptic Technique to Transfer Bacteria” on page 65 of Biotechnology, A Laboratory Course. Students will read passage and identify Level Changes, Action Words, Connectors, and special cases and exceptions. Students will create their own multistep procedure for “Aseptically Transferring Bacteria” (this will be their lab book entry title).

ESE Accommodations & Modifications

- Extended Time
- Preferential Seating
- Segmented Assignments
- Assignment Length
- Peer Tutors
- Other:

ELL Accommodations

A: chunking, modeling, and one-on-one instruction.

¹ From <http://cte.ed.gov/employabilityskills/>

Students will then allow their plates and slants to incubate inside of the incubators at 36 degrees C for 48 hrs. Students will document this information in their lab books including technicians handling the samples, visual drawing of the plate (before and after 48 hrs.) Students will read page 95 of Biotechnology, A Laboratory Course and follow multistep procedures for Quantifying bacterial numbers. Students will create and infographic using easel.ly.com to present their findings.

Lesson Objectives:

- Students will identify all look-fors in the text “Using Aseptic Technique to Transfer Bacteria”.
- Students will create their own Multistep Procedure on “Using Aseptic Technique to Transfer Bacteria” by using 3 of the 4 Look-fors.
- Students will successfully Transfer Bacteria Aseptically.

Instructional Procedures

Opening: Students will watch: Ebola: The Deadliest Outbreak Explained.

<https://youtu.be/JNiH18jNmQA>

Students will be asked before the video: Why is aseptic technique important when handling microorganisms? Have students thinking about this during the video.

Lesson Progression:

Students will begin by watching the video: Ebola: The deadliest Outbreak Explained.

Write on the board: Why is Aseptic Technique important when handling microorganisms? Students will have this question in mind while watching the video and students will write 2 sentences that answers the question stated on the board.

Students will receive the handout: Multistep Procedures Look-Fors. Students will read passage “Use Aseptic Technique to Transfer Bacteria” on page 65 of Biotechnology, A Laboratory Course. Students will read passage and identify Level Changes, Action Words, Connectors, and special cases and exceptions. Students will create their own multistep procedure for “Aseptically Transferring Bacteria” (this will also be their lab book entry title). Students must use three out of the four “Look-Fors” in creating their own multistep procedure.

Teacher will walk around monitoring for students needing assistance. When all students are finished, teacher will go over multi-step procedure and explain expectations on this list.

Students will switch papers with their partner and peer grade their work.

Summative Assessment:

This will be completed by monitoring students while they are identifying the multistep procedures in text. Students are to write them down on their table’s dry erase boards.

Formative Assessments:

B: Categorize vocabulary, word banks

C: charts, computer software, labeling, and worksheet

D: captioning, video

	<p>Their first assessment will be completing their “multistep procedure” using 3 out of the 4 look-fors.</p> <p>Their second assessment will be aseptically inoculating their bacteria correctly and completing their gram stain correctly as well. The gram stain will determine whether they have correctly inoculated their bacteria aseptically.</p> <p>Their third formative assessment is a Tier 3 vocabulary test.</p>	
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