

SHERRY STUBER

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I have taught high school students, the art of problem solving, for the last 29 years. The curriculum topics range from general science, human biology, marine biology, biology to advanced biology, honors biology and for the past 11 years Advanced Placement Biology. In 1997 the Bellevue School District began to redefine and align the district science curriculum with the state ELAR's. The goal was to form an articulated science curriculum through the district, K-12. I have been a member of that district team from the beginning. We are in the process of articulation at all levels. I am a member of the high school science component of this project. I have been a Lesson Study Leader in the district for 2000 –02 and received a "Blue Ribbon" award in 2001 for the "What is a Buffer?" lesson study. It was designed and taught by myself and Bill Palmer to a combined AP Biology / AP Chemistry classroom. What can I say? Teaching defines my life. I have never wanted to do anything else. Each day presents a series of new challenges that make getting up and going to work an adventure.

I have been part of the SEP learning community from the beginning (1991). I have been a Lead Teacher (1997-2000), HutchLab Instructor (1999-2003) and a member of the Elephant project curriculum development team for these past two years.

When I am not teaching, I hike, roller blade, bike ride, jog, cross country ski, train a Chesapeake Bay retriever, grow roses and vegetables, remodel bathrooms and kitchens, oh...and sleep!

**SAMMAMISH HIGH SCHOOL
BELLEVUE PUBLIC SCHOOLS
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- 12 sections of 9th/10th Biology, three teachers, team taught.
- 1 year of Biology is taught in a 1 semester block of 90minutes.
- Each Wednesday is a 60 minute time frame.
- We teach the full curriculum twice during the year.
- 28-30 students per class.
- 1st semester is a combination of 9th/10.
- 2nd semester is a 9th honors track.

Before beginning the Elephant Project, students have completed their year of study on various Biology topics including units on biomolecules, ecology, DNA structure, protein synthesis, genetics, population genetics, natural selection and evolution. The elephant project is used as a culminating project for the year and as an end of the year assessment. It requires students to use previously acquired knowledge and explore the different ways biotechnology can be applied to solve a problem and help save and endangered species.

HOW I CUSTOMIZE THE ELEPHANT PROJECT FOR MY CLASSROOM.

- Previous to the Elephant Project our students have done the SEP Dye Lab. They know how to pour a gel, and have explored the principles of electrophoresis for the separation of molecules. They have been introduced to restriction enzymes and “sticky end cuts” through work with the BioRad PGLO” transformation lab. The Elephant Project is the second opportunity to reinforce these concepts and apply them to another aspect of biotechnology.
- Because our classes are 8 sections one semester and 4 sections the second semester, we choose to label and aliquot all of the simulated elephant DNA samples into micro-centrifuge tubes. The students then add solutions to these samples. This saves on student pipetting errors and helps insure a potential “good gel” for analysis.
- Our TA’s or we, the teachers, do the aliquoting. It may require as many as 64 micro-centrifuge tubes (8 sections x 8 lab groups) per DNA sample. The tubes are labeled by park samples.
- We create 8 React 3 “ buffer tubes, 8 sterile water tubes and 8 Loading Buffer tubes per room.
- We also have the Ivory DNA sample aliquoted for the enzyme digest by the student’s lab teams. You will find a sample of that protocol in this folder. (SHS 3rd Enzyme Digest)

Lesson Flow

The day before we start the Elephant Project, the students read two sections in their Biology text (Modern Biology ed. 1999, Holt) on restriction enzymes, RFLP’s and biotechnology.

Day 1 (90 minutes) ENGAGE

Place “How Can Biotechnology be Used to Save and Endangered Species?” on the board for the theme of the unit. I let the students know that at the end of the unit I will be asking them to tell me “how biotechnology can be used to save an endangered species?”

Show 10 minutes of National Geographic “Wildlife Warriors”. Ask the students to identify the issues surrounding poaching. Ask the question “How can Biotechnology be used to Save an Endangered Species?”

In order to answer this question we need to develop some lab skills first. Micropipetting is one of those skills: 55 minutes of learning how to use the tools and practice of that skill with an evaluation of the skill by students creating micro-centrifuge tubes with set volumes that they pass to a partner to see if the partner can pipette the same volume they have identified.

While all of this is going on: assign members of the lab team to be an expert on:

- Gel pouring and Electrophoresis box set up

- Power supply and the running of the gel

- Loading of the wells and correct micropipetting

- Sample preparation and following of lab protocol.

Web search: for the current Laws and global regulations surrounding the trade of Ivory.

Do a quick run through on the responsibilities for the gel expert and the power supply expert. Students are then ready on the day of the lab to jump right in without a reminder.

Homework:

- Read the “Natural History of the Elephant”.

- Flowchart the Enzyme digest in their journal .

- Give students the map of Africa with the countries.

Day 2 (90 minutes) ENGAGE/EXPLORE

Open with 5-10 minutes of the Discovery Video: An Animals World: African Elephant (1st segment).

Read the Grandparents Scenario. What do scientists need to know and do next to find out where this Ivory came from? Short brainstorming, make a list on the overhead. (need DNA, need RFLP pattern that can distinguish a population one from another, need a data base of populations RFLP etc.)

Share the work of Dr. Wasser and Dr. Comstock. (Show color over heads)

One of the skills we need is an understanding of what an RFLP is and how it is created in the lab. Do RFLP Paper Activity: Alternate Activity (with the printed paragraphs about elephants) This simulates an enzyme digest of a population with RFLP’s.

Quick clean up of paper. Review enzyme digest protocol (this was HW from the night before). Return to the lab and do the digest of the Ivory DNA by BamHI. Leave in the water bath overnight or if this is a Friday, remove and spin down, place in the freezer.

Quick summary of where we are, what we have done and what will happen next. Review the responsibilities of the experts in each lab team.

Homework:

- RFLP assessment

- Read and Flow chart the lab instructions into the student lab journal for the next day’s lab (for us, this was a weekend. We set up the electrophoresis equipment before we left school on that Friday. All of the lab solutions had been aliquoted previous to this day.)

Day 3 (90 minutes) EXPLORE

Lab: Do the Elephant RFLP simulation ...GO

Pour the gel, prepare the samples, load the gel, run for 45 minutes. It will take 30 to 40 minutes for students to have their gels loaded and running.

We used the AP Biology students through out the day to help each general biology lab team prepare their samples and load the gels.

All of the biology teaching staff (3 of us) gave up their prep period to be the second teacher in the room to help with whatever needed to be done. At the end of class, the second teacher helped with the gels, breaking down the box, staining the gels, de-staining the gels and setting up the box up for the next class.

This was a long and very stressful day. We were on our feet from 6:30am to 4:30PM. We were tired. We chose to do it this way because we wanted to keep all of the biology sections together. We have a limited time frame with which to accomplish this at the end of our semester year.

While the gels are running: work on the Comstock Data/Option 1: semi-log graph of Elephant RFLP Data for a database. Students were given this lab sheet as they left the lab room. They were to read the first two pages and then to work on their Concept Questions Part 1/2 in their lab teams. When all teams are done we worked as a group to learn how to plot a standard Ladder on semi-log graph paper. Also we identify the parks on the maps that were given to the students on Day 2. (see OH of African parks and OH of African map vegetation)

Homework:

Concept Questions Part 1 and 2.

Review the lab and predict what you might see on your gel tomorrow.

Day 4 (90 minute) EXPLAIN

Open class with 10 minutes of Discovery Video: An Animals World: African Elephant. (next segment or choose a segment that you like)

Review the semi-log plot for the Comstock Data.

Continue on with how to use the standard curve as a tool to identify the bp sizes of the RFLP bands. Continue with the analysis of the Comstock Data. Teacher functions as facilitator/ students in lab teams.

At some point, the class has to move to the analysis of their own gels. It has been my experience (having taught this unit 4 times to 9th and 10 grade minds) students take some time to grasp the concepts presented in the lab. I allow enough time to get the majority of the class on the same page and then move to the next step. As an opening activity on the next day we will review the main concepts again. The goal is to reach more students each time.

Analysis of our own gel:

Return to the lab room look at the gel and compare it to your prediction in your journal.

Place the gel in a ziplock baggie, label the baggie with team names and date.

Place the gel on a light box, trace the wells and bands on to an acetate sheet. Do this 3 times so that each team member has a copy that they paste into their own journal. We have three light boxes. You can speed up the process by doing one tracing on the light box and then the others from the master copy.

Return to the front of the classroom. Finish the Comstock Data and move to the analysis of your gel and data. See Analysis of Student Data / Comparison of Patterns and Data Submission Form DS 571. We spend time as a group locating the biomes (vegetation) on the student maps. (See the OH of the African Maps)

What is the source of the Ivory? Is Grandpa in trouble?

Homework:

“Finish all the concept questions, be sure that you have completed the lab and questions for both the Comstock Data analysis and the analysis of your gel. Review your lab procedure: What did you do and Why?”

“We will open class tomorrow with the final summary of the lab. We will discuss the fate of Grandpa and the African Elephant, so Web experts be ready with data to back up your statements.”

Day 5 (60 minute) ELABORATE

Open with a BIG summary of this lab and why we did what we did. This involves students asking questions around the Concept Questions: part 1 and 2 along with the vocabulary.

Show another segment on poaching from the National Geographic Video: Wildlife Warriors.

Class discussion of the issues and the source of the Ivory: I let each lab team have time to talk with the web expert to be sure that they understand the current laws and regulations. If the web expert does not have data to share I have several web pages “book marked” for them to use.

Conclude by asking the question: How can Biotechnology be used to Save an Endangered Species? Students should be able to summarize this in verbal form or in their journal. They should also be able to ELABORATE on the current issues surrounding the ivory trade and the current laws that govern this global issue.

Homework

Study for the assessment tomorrow. Be sure to look over the lab and the Concept Questions.

Day 6 (40 minutes of a 90 minute class) EVALUATE