

**The Effects of Integrating Emerging Pathogens**

**Inquiry Based Case Study & Inquiry Based**

**Laboratory Activity on the Interest and**

**Performance of 10<sup>th</sup>, 11<sup>th</sup>, and 12<sup>th</sup> Grade**

**Students in Anatomy & Physiology Classes**

**For**

**CATALySES – Emerging Pathogens**

**Action Research Proposal**

**By**

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**Topic:**

The effects of integrating emerging pathogen blended learning based case study and a blended learning based laboratory activity on the interest and performance of 10<sup>th</sup>, 11<sup>th</sup>, and 12<sup>th</sup> Grade students in anatomy & physiology classes.

**Abstract:**

This action plan is a qualitative approach to assessing the effects of my teaching on student learning, by soliciting feedback from students prior to starting the unit lesson content, and then again at the end of the unit. This survey will ask the students to focus on how they felt they learned the material, and specifically on the teaching and learning practices of the teacher.

The flipped teaching methods will be employed in the unit using the pathogen lessons as an introduction to the overall unit, and then again as an introduction to a section on antigens within the overall unit.

The students will be given an ATSI “Attitude Toward Science Inventory” survey before and after the unit. The numerical values from the survey will be used to assess and compare interest levels. They will also be given pre and post tests on the content of the unit using QUIZZIZ and the data will be collected, using an EXCEL spreadsheet, to evaluate performance levels. They will also be given a performance based assessment using a similar but not identical case study found in the POGIL – Biology Guide.

The lesson focuses on blended learning based instruction that employs problem based learning activity, inquiry based learning activity, and student prior knowledge ( which is not limited by their background).

Action research is an excellent methodology for using inquiry to study teaching practice, student-teacher interactions, and student learning, providing teachers with the tools, philosophy, and practice that allow them to systematically study the effects of their teaching on student learning.

I will use the Ebola Epidemic Activity as an inquiry based introduction to the Chapter 12 unit lesson content “The Lymphatic System and Body Defenses”. This lesson will ask the students to investigate the outbreak of Ebola Virus in West Africa without any significant prior knowledge of the Ebola virus or regarding Chapter 12 material. This activity is designed to spark their interest in the unit as well as in pathogens that attack our immune system either as viruses or as bacteria.

I will use the ELISA antigen lab as an inquiry activity prior to the content lesson Adaptive Body Defenses \*Antigens, \*Cells of the Adaptive Defense System An Overview, Humoral (Antibody-Mediated) Immune Response, Cellular (Cell-Mediated) Immune Response, Organ Transplants and Rejection, Disorders of Immunity.

I will use the PBS Video: ZIKA spillover EBOLA & Beyond, at the end of the unit, section PART III when we discuss critical thinking and clinical application questions.

Additionally, I would like to use;

I would also like to use the Ebola Disease Detectives – Ebola sequences that were obtained from Sierra Leon during the 2014 outbreak in West Africa.

I just have not figured out yet where to place this activity for learning as it relates to DNA and RNA gene expression and mutation for this class.

### **Rationale:**

My particular area of action research emphasis is first to stimulate interest in emerging pathogens through inquiry based learning as an introduction to a unit and secondarily to use qualitative assessment as a way to measure student engagement, teaching and learning practices, and finally as a 360 degree feedback on the unit lessons as well as the teacher presenting them.

In the past 13 years as a teacher in 5 different states, and in 5 different school districts, one thing that has stood out for me as a science teacher, students learn better when they are engaged in an activity that reinforces the content learning. I have also found that even students in the lowest levels of a school quartile with significant classroom modifications can learn if they see science as relatable to their current life experience. They are engaged and are interested, and they are having fun in the process of learning. Too often we forget as adults that learning can be fun, and that we need to go back in our own life experiences and remember how it was for us a young adults trying to figure things out with all of the home and social pressures around us, including having maybe to work to help support the family.

Science is all around us every day and in every activity, science is an ongoing process involving us directly in the process of discovery, observing, and asking questions. It is about our natural world in which we live and participate in. Our introduction to our science students at the beginning of the school year, is that there is only one planet, one biosphere in which we live right now, and it is getting crowded. So, how do we interact within this environment in a sustainable manner, both in a macro-way and in a micro-way. The hook for our students is that life on this planet is all interconnected and that what they do every day is interconnected, so as a teacher I need to create a learning environment that is relevant to their perceptions now, and open their minds to the opportunities science presents to their lives so that they to want to learn more about science.

However, I have found that without exciting stories, like in case studies and laboratory activities, or hands-on activities that are relatable and relevant, my students were not very motivated beyond asking me if this was for a grade. My Action Plan Research is focused on this conundrum for teaching in general and science specifically, How do we actively engage a student to learn, because it is incumbent upon them to seize the opportunity that day for those 45 minutes of time before they move on to the next subject in their schedule. I can create a learning environment, but they have to want to learn that day in class, so how do I help to provide the want to motivation.

Now I understand that not all learning opportunities everyday are blended opportunities employing the problem, inquiry, or prior knowledge. Some of the learning has to be back to the basics, understanding vocabulary, reading passages, and interpreting questions in order to build a foundation of knowledge on which we can explore a content are. I have observed from years of teaching that student engagement in hands on activities and laboratory activities have proven to increase student interest. This was observed many years ago also in a study done to assess students interest levels in a science lab class, (Hofstein & Lunetta, Rev. Educ. Res. 52(2), 201–217, 1982). In another case study done on 183 students who were exposed to inquiry-based learning in science, the researcher found a significant increase in students’ interest in science and problem-solving skills, (Paris, Yambor, Packard). Using some new, current case studies and laboratory activities in the anatomy & Physiology unit, I hope to spark my students’ interest by FLIPPING the paradigm, starting at the end first with an activity and then moving into the content which supports the learning experience, which I am confident will also improve their grades and concurrently their interest and excitement in learning science. This interest and excitement should translate into a more positive frame of reference regarding science and a more positive opinion about learning science in general. It will also provide the opportunity to learn more about my own teaching and learning practices and how effective I am at providing a positive and successful learning environment to my students through this type of engagement to learning.

### **Intervention:**

The Anatomy & Physiology Unit:

Chapter 12 The Lymphatic System and Body Defenses

Goals:

After completing this chapter, you will have a working knowledge of the functions of the lymphatic system and of body defenses and will have mastered the objectives listed below.

Function Preview:

- The lymphatic system returns leaked plasma to the blood vessels after cleansing it of bacteria and other foreign matter. It also provides sites for surveillance by immune system cells.
- The innate defenses hinder pathogen entry, prevent the spread of disease-causing microorganisms, and strengthen the immune response.
- The adaptive defenses protect against disease by destroying “foreign” cells and by inactivating toxins and other foreign chemicals with its antibodies.

## **Standards of Learning**

### **Objective Checklist:**

#### **Part I: The Lymphatic System**

- Name the two major types of structures composing the lymphatic system.
- Describe the source of lymph, and explain its formation and transport.
- Describe the function(s) of lymphatic vessels, lymph nodes, tonsils, the thymus, Peyer's Patches, and the spleen.
- Explain how the lymphatic system is functionally related to the cardiovascular and immune systems.

#### **Part II: Body Defenses**

- Describe the protective functions of the skin and mucous membranes.
- Explain the importance of phagocytes and natural killer cells.
- Describe the inflammatory process.
- Name several antimicrobial substances produced by the body that act in innate body defenses.
- Describe how fever helps protect the body.
- Define ANTIGEN and HAPTEN, and name substances that act as complete antigens.
- Name the two arm of the adaptive defense system, and relate each to a specific lymphocyte type (B or T cell).
- Compare and contrast the development of B and T cells.
- State the roles of B cells, T cells, and plasma cells.
- Explain the importance of macrophages in immunity.
- List five antibody classes, and describe their specific roles in immunity.
- Describe several ways in which antibodies act against antigens.
- Distinguish between active and passive immunity.
- Describe immunodeficiencies, allergies, and autoimmune diseases.

#### **Part I : The Lymphatic System: Lymphatic Vessels, Lymph Nodes, Other Lymphoid**

##### **Organs.**

##### **Week 1:**

##### **Day 1: Introduction to the unit.**

ACTIVITY: EBOLA outbreak activity using the map of Guinea, cards of various groups involved, focusing on the point of origin and the consequences of the virus spreading through inter-relationships. Kit sent to the school for use with two classes of anatomy & physiology. This will open the student's minds into the complex relationships and the content involving the human body micro, but also the human body macro in the environment regarding an outbreak of an infection involving a pathogen.

## **Week 2:**

### **Day 6: Introduction to the section, Part II Body Defenses: Antigens**

ACTIVITY: ELISA – Modified from the Dengue Fever lab by CATALySES – CPET, Kit sent to the school for use by two classes of anatomy & physiology. This will focus specifically on the section Adaptive Body Defenses – Antigens, but will lead into the discussions of the content areas for the whole section.

Innate Body Defenses – surface membrane barriers, internal defenses: cells and chemicals, phagocytes, natural killer cells, inflammatory response, antimicrobial proteins, fever.

Adaptive Body Defenses – antigens, Cells of the adaptive defense system: an overview – lymphocytes, macrophages, humoral (antibody-mediated) immune response – active and passive humoral immunity, antibodies, cellular (cell-mediated) immune response, organ transplants and rejection, disorders immunity.

## **Week 3:**

### **Day 11: Introduction to this section, Part III Developmental Aspects of the Lymphatic System and Body Defenses.**

Video: ZIKA Spillover EBOLA & Beyond, with student video guide.

Critical Thinking and Clinical Application Questions

A Closer Look AIDS: The Modern Day Plague

### **Data Collection and Analysis:**

Data will be collected from pre and post QUIZZIZ tests given to both periods. This will be analyzed using an EXCEL spreadsheet.

Data will be collected on students' attitudes. This will be analyzed using the ATSI survey.

Copy of the survey below, on the next three pages, questions 1 through 48.

### ATTITUDE TOWARD SCIENCE INVENTORY SURVEY

It is important that you respond to every statement, and that you fill in only one number per statement.  
 Attitudes Toward Science Inventory

ATSI ITEM STATEMENTS	STRONGLY DISAGREE	DISAGREE	UNDECIDED	AGREE	STRONGLY AGREE
1. Science is useful for solving the problems of everyday life.	1	2	3	4	5
2. Science is something that I enjoy very much.	1	2	3	4	5
3. I like the easy science assignments best.	1	2	3	4	5
4. I do not do very well in science.	1	2	3	4	5
5. Science teachers show little interest in their students.	1	2	3	4	5
6. Doing science labs or hands-on activities is fun.	1	2	3	4	5
7. I feel at ease in a science class.	1	2	3	4	5
8. I would like to do some extra or un-assigned reading in science.	1	2	3	4	5
9. There is little need for science in most of today's jobs.	1	2	3	4	5
10. Science is easy for me.	1	2	3	4	5
11. When I hear the word "science," I have a feeling of dislike.	1	2	3	4	5
12. Most people should study some science.	1	2	3	4	5
13. I would like to spend less time in school studying science.	1	2	3	4	5
14. Sometimes I read ahead in our science book.	1	2	3	4	5
15. Science is helpful in understanding today's world.	1	2	3	4	5
16. I usually understand what we are talking about in science.	1	2	3	4	5
17. Science teachers make science interesting for me.	1	2	3	4	5
18. I do not like anything about science.	1	2	3	4	5
	1	2	3	4	5

19. No matter how hard I try, I cannot understand science.					
	1	2	3	4	5
20. I feel tense or upset when someone talks to me about science.					
	1	2	3	4	5
21. Science teachers present materials in a way that I understand.					
	1	2	3	4	5
22. I often think, "I cannot do this," when a science assignment seems hard.					
	1	2	3	4	5
23. Science is of great importance to a country's development.					
	1	2	3	4	5
24. It is important to know science in order to get a good job.					
	1	2	3	4	5
25. It does not disturb or upset me to do science assignments.					
	1	2	3	4	5
26. I would like a job that does not use any science.					
	1	2	3	4	5
27. Science teachers know when I am having trouble with my assignments.					
	1	2	3	4	5
28. I enjoy talking to other people about science.					
	1	2	3	4	5
29. I enjoy watching a science program on television.					
	1	2	3	4	5
30. I am good at working science labs and hands-on activities.					
	1	2	3	4	5
31. Science teachers do not seem to enjoy teaching science.					
	1	2	3	4	5
32. I like the challenge of science assignments.					
	1	2	3	4	5
33. You can get along perfectly well in everyday life without science.					
	1	2	3	4	5
34. Working with science upsets me.					
	1	2	3	4	5
35. I remember most of the things I learn in science class.					
	1	2	3	4	5
36. It makes me nervous to even think about doing science.					
	1	2	3	4	5
37. I would rather be told scientific facts than find them out from experiments.					
	1	2	3	4	5
38. Most of the ideas in science are not very useful.					
	1	2	3	4	5
39. It scares me to have to take a science class.					
	1	2	3	4	5



40. Science teachers are willing to give me individual help.					
41. The only reason I am taking science is because I have to.	1	2	3	4	5
42. It is important to me to understand the work I do in the science class.	1	2	3	4	5
43. I have a good feeling toward science.	1	2	3	4	5
44. Science teachers know a lot about science.	1	2	3	4	5
45. Science is one of my favorite subjects.	1	2	3	4	5
46. Science teachers do not like students to ask questions.	1	2	3	4	5
47. I have a real desire to learn science.	1	2	3	4	5
48. If I do not see how to do a science assignment right away, I never get it.	1	2	3	4	5

### **Connections to CATALySES summer institute:**

There will be three Blended Based Learning parts associated with the unit, two of which are directly from the CATALySES Classes, and the third from the POGIL Biology Inquiry Based Activities Manual.

**First**, I will use the Ebola Epidemic in West Africa to introduce the Unit; Ch. 12 The Lymphatic System and Body Defenses.

**Second**, I will use the ELIZA Lab on Dengue Fever (modified) to introduce the section on Part II: Body Defenses.

**Third**, I will use the POGIL Biology Activity on Pathogens as a summative performance based assessment at the very end of the unit, but before the summative written based test on chapter 12

- **Ebola Map Activity Kit– Pathogen Vector Detectors**
- **ELIZA Lab Activity Kit – Dengue Fever (modified)**
- **POGIL Map Activity – Pathogen Vector Detectors**

### **Literature cited:**

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**Pogil Activities for High School Biology, Copyright 2012 HSPI ---The POGIL project and Flinn Scientific, Inc., [www.pogil.org](http://www.pogil.org), National Science Foundation, U.S. Department of Education, Franklin & Marshall College, (ACS, NABT, BCCE, ChemEd, NSTA).**

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**Permissions:**

No permissions are required for the qualitative survey of the students, since they will be using a constructed code which will not reflect upon their individual identity, or on their individual grade.

Additionally all of the survey's will be shuffled in such a way to remove any identity from time of turning it in or by the period in which it was given to the student.

I will also make sure that a period of time has past since the taking of the survey in order to additionally remove any bias.

## SINGLE LESSON PLAN

Teacher: Druyff, Christopher

Content Area/Grade:A&P / 10,11,12

Date: 06/29/17

Unit Name: Ch.12 The Lymphatic System and Body Defenses

### Unit Goal

What unit goal does this daily lesson address?

An introduction to the human bodies defense mechanisms as it pertains to a pathogen in the form of a virus.

### Standard(s)/Benchmark(s)

What standard(s)/benchmark(s) does this daily lesson address?

Scientific Blended Learning: problem and inquiry based learning, activation of prior knowledge.

Collaborative Team based learning

Activity based instruction using Case Study

SC.912.L.14.6, HE.912.C.1.5, 1.3, 2.6, 2.4, 2.7

### Students will understand that...

What should the students understand by the end of today's lesson?

Describe the following for Ebola virus disease: symptoms, sources and risk factors, diagnosis and detection, treatment, prevention and control.

Simulate the spread of an infectious disease

Analyze and graph data, determining dependent and independent variables

### Essential Questions

What essential question(s) does this lesson address?

How do we track an outbreak working backwards to the source of the infection, then work to identify all of the associations spreading out from patient zero.

### Connecting Concepts

How will you review yesterday's content and connect today's lesson to it?

We have been learning about body systems, and then about the bodies chemistry, macromolecules, and DNA / RNA / Protein synthesis. How does this information relate to the virus?

### Organizing Students for Learning

How will students be organized today for the lessons activities?

Groups of 4 working as a team

Team based blended learning

## LEARNING EXPERIENCES, INSTRUCTION AND RESOURCES

What activities or experiences (from your Unit Plan) will students engage in today?

### Lesson Sequence

#### Activating Prior Knowledge

The teacher will ask students to think about diseases in the news, and specifically viruses vs. bacteria.

- ABC Brainstorming
- KWL
- Anticipation Guide
- Card Sort
- X  Think-Pair-Share

#### Explicit Instruction

The teacher will layout the basic information of the lesson and then release the students to work out the scenario of the Case study.

- X  Motivational Hook
- Lecture
- x  Demonstration
- Note-taking Guide

Lesson Sequence				Resources and Materials
<b>Group Processing of New Information</b>	Students will work in groups of 4 with specific roles assigned in order to help facilitate discovery while working together to solve the epidemic as disease detectors	<input type="checkbox"/> Jigsaw <input type="checkbox"/> Reciprocal Teaching <input checked="" type="checkbox"/> Concept Attainment <input checked="" type="checkbox"/> Think-Pair-Share	<input type="checkbox"/> Lab / Inquiry Activity	<input type="checkbox"/> Computer <input type="checkbox"/> LCD Projector <input checked="" type="checkbox"/> Paper <input checked="" type="checkbox"/> Pencils <input type="checkbox"/> Whiteboards <input checked="" type="checkbox"/> Markers <input type="checkbox"/> Butcher Paper <input type="checkbox"/> Response Cards <input checked="" type="checkbox"/> Post-it Notes <input type="checkbox"/> Video Clip(s):  <input type="checkbox"/> Website(s):  <input checked="" type="checkbox"/> Lab Materials:
<b>Elaborative Questioning</b>	<p>Questioning is integral to the case study, teacher will help to facilitate but not specifically answer questions or provide specific guidance.</p> <p>Students need to explore and be able to fail or succeed on their own.</p>	<input type="checkbox"/> Inferential Questions <input type="checkbox"/> Analytic Questions <input type="checkbox"/> Philosophical Chairs		
<b>Demonstrating Understanding</b>	Students can use large post it paper to map out the associations, using color markers.	<input checked="" type="checkbox"/> Graphic Organizers <input type="checkbox"/> Picture Notes <input checked="" type="checkbox"/> Flow Charts <input type="checkbox"/> Concept Maps <input type="checkbox"/> Mnemonics <input type="checkbox"/> Graffiti		
<b>Reflection</b>	Reflection is intrinsic to the case study worksheet questions	<input type="checkbox"/> Reflective Journals <input type="checkbox"/> Think Logs <input type="checkbox"/> Exit Ticket (Student Learning)		
<b>Daily Progress Monitoring Assessment</b>	Students will have to turn in the completed case study for an assessment.	<input type="checkbox"/> Quiz <input type="checkbox"/> Journal <input checked="" type="checkbox"/> Exit Ticket (for Content) <input type="checkbox"/> Response Cards		
<p>Based in the results from your Daily Progress Monitoring Assessment, what concepts need to be revisited in the next lesson?</p> <p>Follow up questions with the class reviewing the answers to the Case study will provide a verbal measurement of the progress.</p> <p>Additional progress monitoring will be based upon the success or failure to complete the assignment and demonstrate a level of knowledge mastery as it pertains to the cases study. Possible a quiz on terms, and concepts using QUIZZIZ.</p>				<b>Homework</b>