

I'm Dengue with the Florida Keys

CATALySES Action Research Proposal 2018

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Abstract: This action research has been designed to expose my IB Biology Seniors to pathogens, the immune system, and the possible labs performed to diagnosis a pathogen using a thematic unit. “The Dengue Dilemma” unit developed by Julie Boker (2013) will be implemented alongside the WISE computer based version of the unit found at <https://wise.berkeley.edu/>. The unit was designed to be a case study based on the first Dengue case that was reported from the 2009 outbreak in Key West. The students will start with the patient’s case report to examine symptoms. Later the students will perform an ELISA test to test for the presence of antibodies followed by running a gel electrophoresis to determine which serotype of Dengue that patient. The students will be exposed to some of the content and lab techniques using the WISE version of the unit at home before coming to class. Once in class we will discuss the content and carry out the labs. This unit will take 5, 100 minutes period is complete and will include homework assignments. The students will complete a pre- and post- surveys about their knowledge of Dengue and the lab test we will be carrying out. The students will also be asked survey question about the structure of the unit and how effective the unit was presenting general content. The lessons will include minimal direct instruction, group work and labs.

Rationale: I have developed this research proposal in response to a lack of focus on pathogens in my IB Biology classes and to teach using a thematic unit. While we discuss pathogens but they are not used as a way to teach other content. For example, the immune system might be taught as a stand alone lesson instead of teaching about the bodies immune response to a particular pathogen. I generally teacher my IB Biology class by topic but there is no theme throughout the unit. This action research cycle will allow me to review content previously taught and introduce new content using a thematic unit. The Dengue Dilemma (2013) unit will provide me with the structure to teach a thematic unit that with cover a variety of topics and allow the students to carry out hands on labs. This action research has been designed to expose the students to Dengue and will give me a chance to teach using a thematic unit, which I have not previously done with fidelity. Feig (2004) challenged teachers to challenge their teaching. “Try something new in the classroom and explore ways to engage your students in the learning process. To become a scientist, a student needs to practice his or her powers of inquiry, observation, interpretations and deduction” (Feig, 2004, 19). By using a thematic unit to teach the immune systems and pathogens I will be trying something new and challenging my teaching. The class in which this thematic unit will be taught is a two year course with the unit being taught in the second year of the course. Therefore, the students will be introduced to a “new” way of teaching and learning. They will be given the opportunity to practice their inquiry skills but in a semi structured way. This thematic unit and the lab component will be a stepping stone for the students to begin their internal assessment. The internal assessment is a lab completely designed and ran by the students. They are allowed to decide the topic and research question. The skills that they practice during the Dengue Dilemma unit will carry over into their internal assessment work. The area of focus of this research to the effectiveness of a thematic unit and its positive impact it will have on the students inquiry and data processing skills.

Intervention: The will be teaching using a thematic unit which includes teaching about the bodies response to Dengue fever, and the test performed to diagnosis an individual with the virus. This unit will be taught to IB Biology students during the first quarter of the second year of the course. We closed the end of the first year with the structure of DNA and RNA, DNA replication, transcription, and translation. The second year of

the course starts with genetics and genetic mutations so the Dengue Dilemma (2013) will be a refresher of the DNA and RNA content but also cover new information, such as, PCR and gel electrophoresis. I have previously taught about pathogens but not with this much detail and not within a thematic unit. The Dengue Dilemma (2013) unit is unlike how I have previously in that the theme of Dengue is through the entire unit. I generally teach by topic as define in the IB Guide but there is not a theme that is within the entire topic.

Data collection and analysis: Pre- and post- surveys will be completed by the students during this unit. Students will be asked about their knowledge of pathogens and dengue as a way to measure the effectiveness of the unit and their increased understanding of the content. The survey will also include questions about how the unit is structures and the students thoughts on the use of a thematic unit to cover content. Lastly, the students will be asked to compare their learning using the WISE version of the Dengue Dilemma verse completing the unit in person.

Connections to CATALySES summer institute: This research is directly connected to the UF CATALySES Institute since I will be implementing the “Dengue Dilemma” unit and using the WISE version of the unit. Both versions of the unit were introduced and carried out doing the CATALySES Institute.

Literature cited:

Boker, J. (2013). The Dengue Dilemma. University of Florida Center for Precollegiate Education and Training. Retrieved from https://www.cpet.ufl.edu/wp-content/uploads/2014/05/DengueCurriculum_Final_LoRes.pdf

Lipson, M. Y., Valencia, S. W., Wixson, K. K., & Peters, C. W. (1993). Integration and Thematic Teaching: Integration To Improve Teaching And Learning. *JSTOR:Language Arts*, 70(4), 252-263.

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Permissions: I will need permission and financial support from my Principal to use funds to pay for the CPET equipment lockers that will be needed.

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CATALySES 2018 LESSON PLAN

<p>Jillian Gregory Community High School Jillian.Gregory@palmbeachschools.org Palm Beach, Florida</p>		<p>Forest Hill West</p>
KEY QUESTION(S):	Identify key question or questions the lesson will explore.	
SCIENCE SUBJECT:	IB Biology (Standard Level)	
GRADE AND ABILITY LEVEL:	11th or 12th grade	
SCIENCE CONCEPTS:	antibody, antigens, disease transmission, DNA, ELISA, immune response, replication, RNA, Polymerase chain reaction, proteins, vectors, virus	
OVERALL TIME ESTIMATE:	Indicate total amount of time needed for the lesson.	
LEARNING STYLES:	Visual, auditory, and kinesthetic.	
VOCABULARY:	<p>List key vocabulary terms used and defined in the lesson. All terms should then be defined and indicated in BOLD in the "Background Information."</p> <p>Acute Agarose Antibody Antigens cDNA DNA Dengue fever Disease transmission ELISA Endemic Epidemiology Gel Electrophoresis Immune system Polymerase Chain Reaction Primary Antibody Proteins Replication RNA RT-PCR Secondary Antibody Vectors Viral Load Viremia Virus</p>	
LESSON SUMMARY:	This lesson will take the students through a case study, using WISE and in person, in which an individual is tested and later diagnosed with the Dengue virus. Using the WISE program and in person students will learn about the Dengue virus and how it is transmitted from its host to a	

	<p>human. In the laboratory, students will be able to carry out an ELISA to test for the presence of antibodies in the patient, they will later run a gel electrophoresis to determine which serotype of the virus the patient was infected with.</p>
<p>STUDENT LEARNING OBJECTIVES WITH STANDARDS:</p>	<p>The student will be able to...</p> <ol style="list-style-type: none"> 1. 2. etc. <p>Number your objectives for easy reference. Focus on what students will KNOW, FEEL, or be able to DO at the conclusion of the lesson, not what they are doing during the lesson. Use specific, measurable, observable verbs. Avoid general terms like “know,” “understand,” or “appreciate.” Include at least ONE objective for EACH subject area addressed. Remember that each objective will require at least one specific assessment. Correlate lesson objectives to state or national standards.</p> <p>Next Generation Sunshine State Standards</p> <p>SC.912.L.14.52 - Explain the basic functions of the human immune system, including specific/nonspecific immune response, vaccines, and antibodies</p> <p>SC.912.L.16.10 - Evaluate the impact of biotechnology on the individual, society, and the environment, including medical and ethical issues.</p> <p>SC.912.L.16.11 - Discuss the technologies associated with forensic medicine and DNA identification, including PCR analysis.</p> <p>SC.912.L.16.12 - Describe how basic DNA technology (gel electrophoresis, polymerase chain reaction, ligation, and transformation) is used to construct recombinant DNA molecules (DNA cloning).</p> <p>SC.912.L.18.1 - Describe the basic molecular structure and primary functions of the four major categories of biological macromolecules.</p> <p>SC.912.N.1.6 - Describe how specific inferences are drawn from scientific observations and provide examples from the content being studied.</p> <p>SC.912.N.3.5 - Describe the function of models in science, and identify the wide range of models used in science.</p> <p>SC.912.N.4.1 - Explain how scientific knowledge and reasoning provide an empirically-based perspective to inform society’s decision making.</p> <p>SC.912.N.4.2 - Weight the merits of alternative strategies for solving a specific societal problem by comparing a number of different costs and benefits, such as human, economic, and environmental.</p> <p>International Baccalaureate Standards</p> <p>Understandings:</p> <p>Topic 2 -</p> <p>2.6.1- The nucleic acids DNA and RNA are polymers of nucleotides.</p> <p>2.6.2- DNA differs from RNA in the number of strands present, the base composition and the type of pentose.</p> <p>2.6.3- DNA is a double helix made of two antiparallel strands of nucleotides linked by hydrogen bonding between complementary base pairs.</p> <p>2.7.1- The replication of DNA is semi-conservative and depends on complementary base pairing.</p> <p>2.7.2- Helicase unwinds the double helix and separates to form a new strand by breaking hydrogen bonds.</p> <p>2.7.3- DNA polymerase links nucleotides together to form a new strand, using the pre-existing strand as a template.</p>

	<p>2.7.4- Transcription is the synthesis of mRNA copied from the DNA base sequences by the RNA polymerase.</p> <p>Topic 3-</p> <p>3.5.1- Gel electrophoresis is used to separate proteins or fragments of DNA according to size.</p> <p>3.5.2- PCR is used to amplify small amounts of DNA.</p> <p>3.5.3- DNA profiling involves comparison of DNA.</p> <p>Application and skills:</p> <p>2.4.1- Rubisco, insulin, immunoglobulins, rhodopsin, collagen, and spider silk as an example of the range of protein functions.</p> <p>2.7.1- Use of Taq DNA polymerase to produce multiple copies of DNA rapidly by the polymerase chain reaction (PCR).</p> <p>3.5.1- Use of DNA profiling in paternity and forensic investigations.</p> <p>3.5.6- Analysis of examples of DNA profiles.</p> <p>Theory of Knowledge:</p> <p>1.5 - Biology is the study of life, yet life is emergent property. Under what circumstances is a system approach productive in biology and under what circumstances is a reductionist approach more appropriate? How do scientist decide between competing approaches?</p> <p>Utilization:</p> <p>Aim 8: Obtaining samples of human blood for immunological, pharmaceutical and anthropological studies is an international endeavour with many ethical issues.</p>
<p>MATERIALS:</p>	<p>Sort materials and indicate number required for different types of grouping formats (Per class, Per group of 3-4 students, Per pair, Per student). Be as specific as possible. No need to list basic instructional items like paper, pencil, chalkboard, or overhead projector.</p> <p>ESSENTIAL:</p> <p>Chromebook to access WISE</p> <p>Epidemiological Report (one per student)</p> <p>Dengue Dilemma lesson 3 materials for simulated ELISA</p> <p>Dengue Dilemma lesson 4 materials for gel electrophoresis (E-Gel PowerBase and adaptor plug on loan from CPET)</p> <p>Dengue Dilemma lesson 5 materials</p> <p>Pipetting by Design equipment locker on loan from CPET</p> <p>SUPPLEMENTAL:</p>
<p>BACKGROUND INFORMATION:</p>	<p>Assume the teacher knows very little about your lesson topic. Provide accurate, up-to-date information from reliable sources. Define all key vocabulary. Usually a minimum of 3 paragraphs and maximum of 2 pages double-spaced.</p>
<p>ADVANCE PREPARATION:</p>	<p>Explain what the teacher needs to do to get ready for the lesson, e.g., choose and mark a study site; prepare a solution; prepare a list of local organisms; obtain news clippings regarding an issue; etc.</p>
<p>PROCEDURE AND DISCUSSION</p>	<p>This is the “heart” of your lesson plan. Assume you are writing this lesson for a substitute teacher to follow. (They do not have any idea what to do unless you clearly explain it to them).</p>

<p>QUESTIONS WITH TIME ESTIMATES:</p>	<p>Divide your procedure into numbered steps with time estimates (in minutes) for each step. Be specific. Don't just say "Introduce concept of food webs." Instead, explain HOW the concept will be introduced. Are you giving a brief lecture? Doing a demonstration? Asking a series of whole-class questions? Showing a film clip?</p> <p>When including discussion questions in a lesson plan, list specific questions to ask and provide sample acceptable answers in parentheses.</p>
<p>ASSESSMENT SUGGESTIONS:</p>	<p>Describe specific assessments for EACH objective: For objective 1... For objective 2... etc. Don't just say "Collect student worksheet " or "Give an oral quiz." Need to clearly indicate the exact question or task that will be used to assess each objective.</p>
<p>EXTENSIONS:</p>	<p>ACTIVITIES: Are there other activities you know of from other resources that relate to this lesson? LITERATURE: Are there trade books, novels, journal articles, or other print materials that focus on the same topic(s) as this lesson?</p>
<p>RESOURCES/REFERENCES:</p>	<p>List all print and/or web-based references/resources used for either lesson ideas or content background information. Provide complete citations for all references.</p>