***WABS STEM PBL Unit/Lesson Plan Template***

**Description:**

Problem-based learning (PBL) is focused, experiential learning organized around the investigation and resolution of messy and real world problems. The Final Unit will allow you to organize your lesson in a problem solving environment where students engage in learning in relevant and connected ways. Teachers function as a coach to guide student inquiry and facilitate learning to deeper levels of understanding for your students.

Research indicates that PBL is a superior pedagogy for promoting student engagement in the learning process. Torp and Sage (2002)1 broaden the impact of this pedagogy and confirm that it increases motivation, makes learning relevant to the real-world, promotes higher order thinking and self-regulated learning in students.

Generally, the teacher will present the problematic situation. The problem is ill-structured and messy (multiple sub-problems), not easily solved and **does not result in one right answer**. Students engage in active problem solving, and teachers guide and coach. A collaborative environment provides for the sharing of information within and between groups as they work to resolve - some may test and re-resolve - their problems. Authentic assessment compliments the problem solving process.

1 Torp, L., & Sage, S. (2002) Problems as Possibilities: Problem Based Learning for k16 Education (2nd ed.). Alexandria, VA: Association for Supervision and Curriculum Development

**PBL Procedure[[1]](#footnote-0): What is in a PBL Unit?**

Use this page as a reference. The PBL procedure may be one lesson or may be the process throughout whole unit. Lessons may focus on a small part of the procedure or highlight the iterative process needed to get closer to a solution**.**

**Understand The Problem*:*** Describe how you will launch your problem. In this portion of the lesson, students will work towards a common understanding of what the problem is and what they need to know in order to solve the problem.

* Introduction/Problem Launch
* Brainstorm What Students Know/Need to Know
* Define/refine the Problem

**Explore the Problem*:*** How will students’ explore multiple ideas, pathways, and challenge their current conceptions? How will all students access the information/context? The students (groups) will develop multiple solutions to the problem based on their evidence that will be shared in the next section.

* Gather Information
* Share Information
* Generate Possible Solutions

**Resolve the Problem*:*** Students should be able to provide an argument for each of the possible solutions and be given an opportunity to share and critique arguments. How will students reflect upon and share what they’ve learned? How will students synthesize their learning? If there are presentations involved with this PBL, how do you plan to help the non-presenters learn from presentations?

* Determine Best Fit solution
* Present the Solution
* Debrief the Problem

**Zika Public Service Announcement**

Target Grade Level(s): 11th-12th

Subject(s): Anatomy and Physiology

Author(s): Corie Gudgeon, Meghan Maves-Watson, Vikas Ghai, Hannah Chapin

**Problem Statement:**

The global society is more connected than ever, but with globalization comes a lack of isolation/separation not only for humans but for all organisms in our ecosystem. That means the barrier between disease outbreak and control has become more porous. One such virus that is spreading currently is the zika virus, which has lead to thousands to cases of microcephaly world-wide. The zika virus has made its way to the United States, and while not in all states yet, has the potential to spread to them. Each year thousands of college students spring break in Florida, a state that currently has the most cases of mosquito-borne zika. Your task is to create a communication tool/PSA educating potential travelers to Florida of the risk and/or precautions to take to minimize the chances of them catching and possibly spreading zika.

Your completed product should include the following:

1. A biological component explaining your understanding of the virus, lifecycle including its host/infection vector, how it infects the body, body systems that it impacts/targets and its effect on those systems, the body’s immune response to the virus, any secondary syndromes associated with contracting the virus, acquired immunity following infection, diagnostics used to identify infected individuals.
2. An epidemiological component explaining your understanding of how the virus spreads including human and non-human transmission, location(s) and size/# of infected individuals of documented outbreaks including if it was contracted while traveling or locally, any specific populations at risk, where/when was disease first recognized/identified, mortality rates, methods used to track outbreaks, potential at risk areas for future outbreaks and justification.
3. An environmental/social component that explains your understanding of the environment where the virus first appeared and currently thrives; description of affected communities including age groups/at-risk populations, infrastructure, politics, living conditions; changes leading to spread including environmental changes due to human behaviors (ex. deforestation); and what solutions to control its spread have been tried and with what degree(s) of success?
4. Recommendations to travelers regarding precautions they should follow while traveling and upon return to prevent local transmission (must be ethical and practical precautions).

**Unit Overview and Table of Contents**

It would be helpful for students to have experience with PBL before starting this unit, but is not mandatory. Experience working in groups for 21st century skills as well as processing and decision making within a group is also a good thing for students to have going into this.

In terms of content students could complete this as a stand alone unit or more of a comprehensive unit on infectious agents, the nervous system, and/or lymphatic system. The basic concepts covered within the unit as we implemented it in our Anatomy and Physiology classes (as a way to teach content relevant to a problem) are:

* The nervous system
* The lymphatic system
* Health science careers (epidemiology, outbreak patterns, etc…)
* Viruses
* Bioethics
* Human impact/influence on the environment
* Processing and Decision making

Lesson 01: Introduction to Problem, Determining Knows and Need to Knows (52 mins.)

Lesson 02: Zika/Pathogens Webquest, determine what subject(s) class needs further instruction on (steer toward nervous and lymphatic systems). (52- 104 mins.)

Lesson 03: Nervous system instruction (52- 156 mins.) Discussion and Notes

Lesson 04: Lymphatic System/Body Defenses/Acquired and Innate Immunity (52-104 mins.) including a bioethics scenario on vaccines. Jigsaw with form and skit. Then Bioethics scenarios/Values Continuum.

Lesson 05: Expert Groups (52-104 mins.)

This unit uses the “jigsaw” approach. Every student will be initially placed into an epidemiological, biological, or environmental/social group. Groups meet together to learn the background about their expertise area (ie what is epidemiology, what are possible careers within the field, and preparation for said careers) and explore/research the virus through the lense of their role.

Lesson 06: Small Groups (one of each expert) (104-208 mins.)

Students represent their role in a group of three and work together to create their communication tool/PSA. (decision making component here when students decide which recommendations to make/include in PSA)

Lesson 07: Report out/share finished product with class (52-104 mins.)

Depending on time and size of class choose gallery walk, elevator speeches, etc… Include some sort of analysis of each other’s projects as well as reflection on their own taking into account peer feedback/what they did already.

**Provide the following items for the entire unit:**

**Standards (NGSS, CCSS, CTE):**

NGSS Practices

1. Asking questions (for science) and defining problems (for engineering)

2. Developing and using models

3. Planning and carrying out investigations

4. Analyzing and interpreting data

5. Using mathematics and computational thinking

6. Constructing explanations (for science) and designing solutions (for engineering)

7. Engaging in argument from evidence

8. Obtaining, evaluating, and communicating information

**NGSS HS-LS1-2** Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

**NGSS HS-LS2-6** Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.

**NGSS HS-LS2-7** Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

**NGSS HS-LS4-5** Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (2) the extinction of other species.

**NGSS HS-ETS1-2** Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

**Stem Connections:** This unit involves working with science and technology throughout the entire unit.

**Soft Skills:**

Collaboration, Creativity, Communication, Problem-Solving, Critical Thinking, Enthusiasm, Evaluating a source, Productivity, Accountability, Leadership, Responsibility, Flexibility, Adaptability, Initiative/Self-direction, using constructive criticism.

**Locally and/or Personally Relevant for Students:**

The global society is more connected than ever, but with globalization comes a lack of isolation/separation not only for humans but for all organisms in our ecosystem. That means the barrier between disease outbreak and control has become more porous. This affects student’s daily lives, as it has to do with public health safety and their communities and family members locally and globally.

**Connections to career and educational pathways:**

As an “expert” students will learn about their field and possible careers within it. Students will be assigned one of three roles/groups (biological, epidemiological, environmental/social) and research/answer specific questions. Careers within these group include; doctors/physicians (neurologists, pediatricians) scientists/researchers (virologists, epidemiologists), community health workers, and social workers. During the 5th lesson (Experts Group) there would be the opportunity to have experts in some of these career pathways join as a guest speaker. While this is not a required part of this lesson, if there is the opportunity to invite a guest speaker it would be highly valuable. A good place to identify these members of your community is in departments of local universities and colleages. For example the University of Washington Virology Department (<http://depts.washington.edu/uwviro/>) has many experts relevant to this PBL and relevant career pathways, as does Western Washington University Biology Department (<https://cse.wwu.edu/biology>). Local county public health departments may also have valuable resources to find community members with relevant career pathways.

**Lesson 01: Introduction to Problem, Determining Knows and Need to Knows.**

This page should be repeated for each individual lesson that makes up the unit.

**Problem statement:** Your task is to create a communication tool/PSA educating potential travelers to Florida of the risk and/or precautions to take to minimize the chances of them catching and possibly spreading zika.

**Learning objectives:** Students will be able to determine what they need to do in order to successfully complete the project, what they know already, and what they do not know yet that they will need to know.

**Lesson standards (NGSS, CCSS, CTE):**

NGSS Practice 1. Asking questions (for science) and defining problems (for engineering)

**Skills and Relevance:**

**Soft skills:** Problem-Solving, Critical Thinking, Evaluating a source, Productivity, Accountability, Leadership, Responsibility, Initiative/Self-direction

**Locally and/or personally relevant for students:**

People travel and so even in local communities individuals who may not travel could be exposed to pathogens via those who do.

**Connections to career and educational pathways:**

Engineering Design Process: by accessing their current knowledge level they will use skills like problems solving, critical thinking, and Evaluating a source that are used in the careers associated with this topic

**Materials:** Access to educational resources, internet, and the Understanding the Project worksheet (L1), which includes project explanation handout and video (<http://abcnews.go.com/Nightline/video/zika-virus-outbreak-inside-hot-zone-36706014>).

**Lesson preparation:** Understanding the Project worksheet handout, Chromebooks

**Time required:** 52 mins.

**Grouping of students for instruction:**

Students will be grouped together for the lesson, and use a think-pair-share (TPS) learning strategy to brainstorm for this lesson.

**What is the instruction? Consider the PBL Procedure that is being addressed here:** In this portion of the lesson, students will work towards a common understanding of what the problem is and what they need to know in order to solve the problem. The teacher is wandering around asking questions, redirecting students to the task at hand, etc… Students are reading the problem statement and answering the questions on the worksheet.

**Understanding the Problem**

|  |  |
| --- | --- |
| **Teacher** | **Student** |
| Introducing the problem launch using a video. Provide the problem statement and the Understanding the Problem worksheet. | Determine the problem, a baseline knowledge about the problem, and information needed to successfully complete problem task. |
| Facilitating individual work, small group/pair and whole class discussion. | Answering the worksheet questions individually to get engaged then sharing/discussing with neighbors and the whole class to fill in gaps. |

**Accommodations:** Give students one question at a time with frequent checks for understanding, assign questions as a jigsaw or to small groups and pair lower students with higher students.

**Extensions:** Start researching and find possible reputable sources for need to knows.

**Assessment:**

Students will be assessed on this problem by completion of worksheet and discussion. The final product will be a completed worksheet. The final product criteria will be made known to students prior to completing their task. There will be both whole group elements and individual accountability.

Formative Assessment in the Lessons: worksheet

Summative Assessment for the Unit: PSA

**References/Resources:**

-Understanding The Project Worksheet (L1)

-Recommended video linked on worksheet: “Zika Virus Outbreak: Inside the Hot Zone”: http://abcnews.go.com/Nightline/video/zika-virus-outbreak-inside-hot-zone-36706014

-Additional video resources from CDC: <https://www.cdc.gov/zika/comm-resources/video.html>

**Optional career extension: Epidemiologist (similar in content to what is covered in Lesson 5)**

[Epidemiologists](http://www.publichealthonline.org/epidemiology/) (<http://www.publichealthonline.org/epidemiology/>) work to understand how diseases spread and then how to treat or limit diseases that currently affect populations.

- Research epidemiologists work in laboratories to understand the science behind how diseases affect organisms. They generally work in universities and might use genetics, cell biology, statistics or field work to understand disease.

- Applied epidemiologists work with governmental or health organizations that try to keep people healthy. Their day-to-day work is mostly in an office, talking with the public, elected officials and people who make decisions about health.

- Infection control epidemiologists work to keep bacteria or diseases from spreading in hospitals or health care facilities.

- Field epidemiologists go to the location in the world where there is an outbreak and then take samples or interview people to learn about how the disease is spreading.

Most of these jobs require that a person have college degree and then a masters (MPH, masters of public health), though doctors (MDs), nurses (RNs) and PhDs also do some of this work.

**Lesson 02: Zika Webquest**

This page should be repeated for each individual lesson that makes up the unit.

**Problem statement:** Your task is to create a communication tool/PSA educating potential travelers to Florida of the risk and/or precautions to take to minimize the chances of them catching and possibly spreading zika.

**Learning objectives:** Students will be able to locate and synthesize information about the Zika virus, symptoms, and spread to build on foundational knowledge determined in lesson 1.

**Lesson standards (NGSS, CCSS, CTE):**

NGSS Practices

4. Analyzing and interpreting data

6. Constructing explanations (for science) and designing solutions (for engineering)

8. Obtaining, evaluating, and communicating information

**Skills and Relevance:**

**Soft skills:** Problem-Solving, Critical Thinking, Evaluating a source, Productivity, Accountability, Leadership, Responsibility, Initiative/Self-direction

**Locally and/or personally relevant for students:**

People travel and so even in local communities individuals who may not travel could be exposed to pathogens via those who do.

**Connections to career and educational pathways:**

Engineering Design Process: by accessing their current knowledge level they will use skills like problems solving, critical thinking, and Evaluating a source that are used in the careers associated with this topic

**Materials:** Access to educational resources, internet, Webquest handout (L2), project explanation handout.

**Lesson preparation:** Webquest handout, Chromebooks, Check that all sites are functional and can be accessed on campus.

**Time required:** 52-104 mins.

**Grouping of students for instruction:**

Individual with the possibility of pairs.

**What is the instruction?** In this portion of the lesson, students will build on foundational knowledge regarding Zika, causes, effects, transmission, systems impacted, etc... The teacher is wandering around asking questions, redirecting students to the task at hand, etc… Students are reading the questions and locating answers using sources provided.

**Understanding the Problem**

|  |  |
| --- | --- |
| **Teacher** | **Student** |
| Introducing the webquest/task at hand. Provide the webquest and Chromebooks. | Using handout sites/sources to answer questions. |
| Facilitating individual work, small group/pair and whole class discussion. | Answering the worksheet questions individually to get engaged then sharing/discussing with neighbors and the whole class to fill in gaps. |

**Accommodations:** Give students a blank model to fill in rather than having them make their own from scratch.

**Extensions:** Compare sources and determine how to tell if a source is reputable. Could take away the dates and have higher achieving students find their own resources/dates/information.

**Assessment:**

Students will be assessed on this problem by completion of webquest and discussion. The final product will be a completed worksheet. The final product criteria will be made known to students prior to completing their task. There will be both whole group elements and individual accountability.

Formative Assessment in the Lessons: worksheet

Summative Assessment for the Unit: PSA

**References/Resources:**

-Webquest (L2)

**Lesson 03a: Nervous system instruction**

This page should be repeated for each individual lesson that makes up the unit.

**Problem statement:** Your task is to create a communication tool/PSA educating potential travelers to Florida of the risk and/or precautions to take to minimize the chances of them catching and possibly spreading zika.

**Learning objectives:** Students will be able to understand the general functions of and organization of the nervous system including structure and function, and learn how the Zika virus affects the nervous system through examples and case studies.

**Lesson standards (NGSS, CCSS, CTE):**

NGSS Practices

4. Analyzing and interpreting data

6. Constructing explanations (for science) and designing solutions (for engineering)

8. Obtaining, evaluating, and communicating information

**NGSS HS-LS1-2** Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

**Skills and Relevance:**

**Soft skills:** Problem-Solving, Critical Thinking, Evaluating a source, Productivity, Accountability, Leadership, Responsibility, Initiative/Self-direction

**Locally and/or personally relevant for students:** Neurons allow us to experience the external

world, put it into internal experience and form thoughts and memories.

**Connections to career and educational pathways:** Peer teaching to fellow students,

**Materials:** Access to educational resources, internet

**Lesson preparation:**

Station 1: coloring/diagramming/modeling possible source:

(L3a) Nervous System Packet <http://www.lake.k12.fl.us/cms/lib05/FL01000799/Centricity/Domain/3748/nervous%20packet.pdf>

(L3a) Nervous System Packet Answer Key (answer key <http://teachers.sduhsd.net/ahaas/Anatomy%20Physiology/nervous%20system/Nervous%20system%20coloring%20questions%20intro%20key.pdf>)

Station 2: video or powerpoint on basic function (possibly [this explanation](http://learn.genetics.utah.edu/content/neuroscience/neurons/) (<http://learn.genetics.utah.edu/content/neuroscience/neurons/>) and [this video](http://learn.genetics.utah.edu/content/neuroscience/crossingdivide/) (<http://learn.genetics.utah.edu/content/neuroscience/crossingdivide/>) )

Station 3: [Make a mad neuron](http://learn.genetics.utah.edu/content/neuroscience/madneuron/) interactive video and [Arcade Brain games](http://www.anatomyarcade.com/games/gamesNervous.html)

Station 4: Big piece of paper on the table and kids given time to research on the internet to find info on “Zika’s effects on the nervous system” colors tied to location, stage of development and unusual terminology (possible sources:

(L3a) Brain Facts Zika <http://www.brainfacts.org/Diseases-Disorders/Childhood-Disorders/Articles/2017/Stifled-Cells-How-Zika-Halts-the-Developing-Brain-022317> and/or (L3a) BrainFactsFightingZika <http://www.brainfacts.org/About-Neuroscience/Animals-in-Research/Success-Stories/Articles/2016/Combating-Zika-Virus-081116>)

Station 5: how the nervous system is formed in development:<https://embryology.med.unsw.edu.au/embryology/index.php/Neural_System_Development> or or <https://www.youtube.com/watch?v=Cu4lQYbOzzY>.

**Time required:** 52 mins.

**Grouping of students for instruction:**

Individual with the possibility of pairs.

**What is the instruction? Consider the PBL Procedure that is being addressed here:** In this lesson students gain information about the basics of neurobiology, using guided research prompts to focus their learning on the major issues of neurobiology and nervous system development.

**Understanding the Problem**

|  |  |
| --- | --- |
| **Teacher** | **Student** |
| Set up stations | Follow directions at the stations to accomplish the tasks at hand (handouts, models, etc) |
| Facilitating spontaneous, brief class discussions to highlight ties between stations, encouraging students to see how the information connects. | Completing a handout that collects and summarizes their information |

**Accommodations:** As needed extend time at each station, reduce the number of deliverables, use fewer stations.

**Extensions:** Use the Brain Development Lesson: (L3a) Brain Development Teacher

**Assessment:**

Students will be assessed on the completion of a summative worksheet.

Formative Assessment in the Lessons: worksheet

Summative Assessment for the Unit: PSA

**References/Resources:**

See above

**Optional career extension:** [**Neuroscientists**](https://en.wikipedia.org/wiki/Neuroscientist)(https://en.wikipedia.org/wiki/Neuroscientist)

If you’re interested in discussing articles about current advances in neurobiology, [ScienceDaily](https://www.sciencedaily.com/terms/neurobiology.htm) (https://www.sciencedaily.com/terms/neurobiology.htm) is a great resource. [This (http://web.mbb.arizona.edu/sites/web.mbb.arizona.edu/files/What%20can%20I%20do%20with%20a%20degree%20in%20Neurobiology%20%28Harvard%29.pdf)](http://web.mbb.arizona.edu/sites/web.mbb.arizona.edu/files/What%20can%20I%20do%20with%20a%20degree%20in%20Neurobiology%20%28Harvard%29.pdf) is a long list of possible careers for folks interested in neurobiology. Neuroscientists might work in the laboratory using model systems (like mice or flies) to understand how nervous systems function. Clinical neurologists work with patients to diagnose or help them cope with specific neurological symptoms.

**Lesson 03b**

This follows directly from the information presented in Lesson 3 and provides a Zika-focused extension/application of the basic biology

**Problem statement:** Your task is to create a communication tool/PSA educating potential travelers to Florida of the risk and/or precautions to take to minimize the chances of them catching and possibly spreading zika.

**Learning objectives: Students will be able to** discover how Zika effect neurons.

**Lesson standards (NGSS, CCSS, CTE):**

NGSS Practices

4. Analyzing and interpreting data

6. Constructing explanations (for science) and designing solutions (for engineering)

8. Obtaining, evaluating, and communicating information

**NGSS HS-LS1-2** Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

**Skills and Relevance:**

**Soft skills:** Problem-Solving, Critical Thinking, Evaluating a source, Productivity, Accountability, Leadership, Responsibility, Initiative/Self-direction

**Locally and/or personally relevant for students:** Neurodevelopmental defects affect many people around the world, causing severe impairments, defects, and potentially lethality.

**Connections to career and educational pathways:** Students will learn about career and educational pathways that seek to study and understand that causes of neurodevelopmental defects.

**Materials:** Case study (L3b) [Bringing Home More Than a Medal](http://sciencecases.lib.buffalo.edu/cs/files/zika.pdf) (<http://sciencecases.lib.buffalo.edu/cs/files/zika.pdf>) as well as this [CDC resource about Zika](https://www.cdc.gov/zika/symptoms/index.html) (https://www.cdc.gov/zika/symptoms/index.html)

**Lesson preparation:** Print the case study, prepare any addition introductory or discussion materials

**Time required:** 52 mins.

**Grouping of students for instruction:**

Can be completed individually or in small groups

**What is the instruction? Consider the PBL Procedure that is being addressed here:** Students are provided with a case study to clarify how Zika causes its symptoms through effects on the nervous system.

**Understanding the Problem**

|  |  |
| --- | --- |
| **Teacher** | **Student** |
| Provide the case studies | Work through the case studies and related questions, convey information to peers |

**Accommodations:** As needed pare down workload (less questions), give students one question at a time with frequent checks for understanding, give more information within the case study or more resources to answer the questions.

**Extensions:** Give less information to students, have students design a tool to communicate Zika’s impact on the nervous system..

**Assessment:** Students are assessed through completed case study questions.

**References/Resources:** [National Center for Case Study Teaching in Science (NCCSTS) (http://sciencecases.lib.buffalo.edu/)](http://sciencecases.lib.buffalo.edu/)

**Lesson 04a: Immunology**

This page should be repeated for each individual lesson that makes up the unit.

**Problem statement:** Your task is to create a communication tool/PSA educating potential travelers to Florida of the risk and/or precautions to take to minimize the chances of them catching and possibly spreading zika.

**Learning objectives: Students will be able to** understand the basics of immune system function and apply this new knowledge to the challenge of vaccines and related bioethical concerns.

**Lesson standards (NGSS, CCSS, CTE):**

NGSS Practices

4. Analyzing and interpreting data

6. Constructing explanations (for science) and designing solutions (for engineering)

8. Obtaining, evaluating, and communicating information

**NGSS HS-LS1-2** Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

**Skills and Relevance:**

**Soft skills:** Problem-Solving, Critical Thinking, Evaluating a source, Productivity, Accountability, Leadership, Responsibility, Initiative/Self-direction

**Connections to career and educational pathways:** Students will learn about career and educational pathways that seek to study and understand the immune systems and its applications to human health.

**Materials:**

Clay/playdough

4 copies of each of two different kinds of stamps (or stampable objects - end of a whiteboard or paper marker, etc).

(L4a) Virus attack coloring pages

**Lesson preparation:**

**Time required:** 52 mins.

**Grouping of students for instruction:**

Immunology activity: class interaction

**What is the instruction? Consider the PBL Procedure that is being addressed here:**

**Understanding the Problem**

|  |  |
| --- | --- |
| **Teacher** | **Student** |
| Facilitates the task of having the students simulate the immune system fighting off invaders. | Kinesthetically learn through the role play simulation of the immune system and how it works. |

**Activity**

viral pathogen (with antigen - marker or stamp)

immune cells

14 kids: 4 immune cells, 10 as viruses

Students that are immune cells hold a piece of clay

Students that are the virus hold a marker (or stamp)

Virus enters the room (or area of the room)

The FIRST time an immune cell encounters a virus it stamps the clay with the virus’s marker and then has to go to the other side of the room (to get the specific killing props they brought?)

The subsequent times the immune cell meets a virus, if it recognizes the virus (has the same stamp) it kills it (student sits down or closes their eyes or \_\_\_\_\_\_)

Do the first round with all viral particles having the same stamp (extension for longer class period or more students is having two different stamps)

Run it and mark the time after beginning when all viruses are dead

Run it a second time but don’t make the immune cells clear their clays or return their weapons - the viruses start dying immediately - this is the idea of vaccination!

Everyone write a paragraph summarizing how the immune system works

**Accommodations:** Alternate mode of summarizing such as verbal or visual. Have a reading on the immune system for students who get overwhelmed by larger groups of people.

**Extensions:** Have students design/draw a comic for any students who were absent to explain the immune system to them.

**Assessment:** Look over/share aloud paragraphs

**Homework:** Have students complete the (L4a) Virus attack coloring pages

**References/Resources:**

Virus attack coloring book (L4a) if need the original link: *https://askabiologist.asu.edu/sites/default/files/resources/coloring\_pages/pdf/AAB\_viral\_attack\_coloring\_packet.pdf*

**Optional career extension: Immunologist**

Research immunologists might conduct experiments in a laboratory to understand how immune systems function (or fail to work). [Clinical immunologists](http://www.aboutbioscience.org/careers/immunologist) (<http://www.aboutbioscience.org/careers/immunologist>) would work with patients, helping them with allergies or other [immunology-related health challenges](http://www.aaaai.org/professional-education-and-training/careers-in-a-i) (<http://www.aaaai.org/professional-education-and-training/careers-in-a-i>).

**Lesson 04b: Bioethics**

This page should be repeated for each individual lesson that makes up the unit.

**Problem statement:** Your task is to create a communication tool/PSA educating potential travelers to Florida of the risk and/or precautions to take to minimize the chances of them catching and possibly spreading zika.

**Learning objectives:**

Apply immune system knowledge to the challenge of vaccines and related bioethical concerns

**Lesson standards (NGSS, CCSS, CTE):**

NGSS Practices

4. Analyzing and interpreting data

6. Constructing explanations (for science) and designing solutions (for engineering)

8. Obtaining, evaluating, and communicating information

**Skills and Relevance:**

**Soft skills:** Problem-Solving, Critical Thinking, Evaluating a source, Productivity, Accountability, Leadership, Responsibility, Initiative/Self-direction

**Connections to career and educational pathways:** Students will learn about career and educational pathways that seek to study and understand the immune systems and its applications to human health.

**Materials:** Day 1: (L4b) Vaccinations Entry Task Slip, video (see below for link), (L4b) Student Copy of Frontline's The Vaccine War Qs, (L4b) Frontline’s the Vaccine War Homework Questions Day 2: (L4b) Bioethical Issues, (L4b) Bioethics Group Scenarios Worksheet, (L4b) Vaccinations Exit Slip

**Lesson preparation:** print out video and homework questions, set up four corners around the room for day 2.

**Time required:** 104 mins.

**Grouping of students for instruction:**

Bioethics: Individual and whole class.

**What is the instruction? Consider the PBL Procedure that is being addressed here:**

**Understanding the Problem**

|  |  |
| --- | --- |
| **Teacher** | **Student** |
| Gives students bioethical issue scenarios and facilitates groups working together. | Works with teammates through a bioethical issue scenario and helps the group determine what the ethical thing to do is. |

**Activity**

*Bioethics discussion*: Day 1- Students will complete a Vaccinations two question entry task prior to watching video and take notes on questions provided. In small groups they discuss video questions and mandatory vaccination, transmission/containment, and environmental ramifications and then report out to other members of the class.

Day 2- Students turn and talk about the homework discussion questions from yesterday at their tables. Discussion question may want to be adapted for time allowances and class schedule. Use the Fishbowl technique for a whole class discussion. Half students on the inside and half students on the outside for each question and then switch students up for each questions. (15 minutes for a class of 13 students)

Next activity is to break students up into small groups of 2 or 3 and give each group a bioethical issue scenario for them to work through as a group and complete the group scenario record sheet. Groups will then share out their scenarios and conclusions to the class. (13 minutes for a class of 13 students)

To wrap-up- Have students complete the exit slip and then do a four corner zones in the room: Keep the current recommendations for vaccinations as they are but parents still decide, Mandatory no opt out unless you have a health reason (i.e. allergic to something in the vaccine), Still vaccinate but on an alternate schedule, and No vaccines.

Students will go to the appropriate location that represents how they feel and will be ready to share out why they chose their location either aloud or off their exit ticket depending on time. (Allow 9 minutes for exit task completion and four corners activity for a class of 13)

Mandatory vaccination - pros/cons rationale

Transmission/containment - what do you do with someone who is contagious, how limit exposure

Environmental ramifications of treatment that involves sterilizing mosquitoes

**Accommodations:** As needed pare down workload (less questions), give students one question at a time with frequent checks for understanding.

**Extensions:** (L4b) Enrichment questions for if time allows or students are advanced

**Assessment:** Completed video analysis sheet, (L4b) exit task, and teacher observation during discussion.

**References/Resources:**

*Frontline Video:* [*http://www.pbs.org/wgbh/pages/frontline/the-vaccine-war/*](http://www.pbs.org/wgbh/pages/frontline/the-vaccine-war/)

*Teacher info:* [*https://www-tc.pbs.org/wgbh/pages/frontline/teach/vaccine/vaccine.pdf*](https://www-tc.pbs.org/wgbh/pages/frontline/teach/vaccine/vaccine.pdf)

[*http://www.aeseducation.com/health-science-curriculum-resources*](http://www.aeseducation.com/health-science-curriculum-resources)

[*https://www.cdc.gov/mmwr/preview/mmwrhtml/su6201a2.htm*](https://www.cdc.gov/mmwr/preview/mmwrhtml/su6201a2.htm)

*Fishbowl strategy*: <https://www.facinghistory.org/resource-library/teaching-strategies/fishbowl>

**Lesson 05: Expert Groups**

**Problem statement:** Your task is to create a communication tool/PSA educating potential travelers to Florida of the risk and/or precautions to take to minimize the chances of them catching and possibly spreading zika.

**Learning objectives:** Students will be able to explore and share expert roles and findings regarding zika from a specific expert viewpoint.

**Lesson standards (NGSS, CCSS, CTE):**

NGSS Practices

1. Asking questions (for science) and defining problems (for engineering)

2. Developing and using models

4. Analyzing and interpreting data

5. Using mathematics and computational thinking

6. Constructing explanations (for science) and designing solutions (for engineering)

7. Engaging in argument from evidence

8. Obtaining, evaluating, and communicating information

**NGSS HS-LS1-2** Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

**NGSS HS-LS2-6** Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.

**NGSS HS-LS2-7** Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

**NGSS HS-LS4-5** Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (2) the extinction of other species.

**Skills and Relevance:**

**Soft skills:** Problem-Solving, Critical Thinking, Evaluating a source, Productivity, Accountability, Leadership, Responsibility, Initiative/Self-direction

**Connections to career and educational pathways:** Students will learn about career and educational pathways relating to different expert groups on how they study and understand Zika from different standpoints

**Materials:** Computers, (L5) Expert Group Questions, (L5) Zika PBL Expert Specialized Questions

**Lesson preparation:** determining/evaluating the credibility of a source.

**Time required:** 52-104 mins.

**Grouping of students for instruction:**

Larger “expert” groups and then smaller groups of 3-4 (one of each expert).

**What is the instruction? Consider the PBL Procedure that is being addressed here:**

Students will be assigned one of three roles/groups (biological, epidemiological, environmental/social) and research/answer specific questions, share with their expert group, and be ready to regroup into small groups with at least one of each expert.

**Understanding the Problem**

|  |  |
| --- | --- |
| **Teacher** | **Student** |
| Direct students into groups, ask questions/guide if off task or stuck. | Work through the expert groups and related questions, convey information to peers |

**Accommodations:** As needed pare down workload (less questions), give students one question at a time with frequent checks for understanding, give sources to students rather than having them find the answers and sources for the answers themselves.

**Extensions:** Make an annotated bibliography for where answers to questions came from. Have students make a database/master list of Zika resources. Decide which ones are better than others.

**Assessment:** Completed worksheets, and ability to describe/discuss zika from their assigned viewpoint and then all three.

**References/Resources:**

[www.readwritethink.org](http://www.readwritethink.org)

**Lesson 06: Work on Communication Tool/PSA**

**Problem statement:** Your task is to create a communication tool/PSA educating potential travelers to Florida of the risk and/or precautions to take to minimize the chances of them catching and possibly spreading zika.

**Learning objectives:** Students will be able to create a PSA incorporating ideas from all three expert groups.

**Lesson standards (NGSS, CCSS, CTE):**

NGSS Practices

1. Asking questions (for science) and defining problems (for engineering)

2. Developing and using models

4. Analyzing and interpreting data

5. Using mathematics and computational thinking

6. Constructing explanations (for science) and designing solutions (for engineering)

7. Engaging in argument from evidence

8. Obtaining, evaluating, and communicating information

**NGSS HS-LS1-2** Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

**NGSS HS-LS2-6** Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.

**NGSS HS-LS2-7** Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

**NGSS HS-LS4-5** Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (2) the extinction of other species.

**Skills and Relevance:**

**Soft skills:** Problem-Solving, Critical Thinking, Evaluating a source, Productivity, Accountability, Leadership, Responsibility, Initiative/Self-direction

**Connections to career and educational pathways:** While working on their PBL, students will learn about career and educational pathways relating to different expert groups on how they study and understand Zika

**Materials:** (L6) PSA Rubric, (L6) Communication tool/PSA Planning Sheet Checklist, supplies for PSA.

**Lesson preparation:** Reserve computers, PSA supplies, students need to have expert group questions completed.

**Time required:** 104-208 mins.

**Grouping of students for instruction:**

Small groups of 3-4 with at least one “expert” from each group (epidemiological, biological, environmental/social).

**What is the instruction? Consider the PBL Procedure that is being addressed here:**

Students will work on their communication tool/PSA in small groups.

**Understanding the Problem**

|  |  |
| --- | --- |
| **Teacher** | **Student** |
| Circulating, helping, directing students to work and find resources. | Researching and creating their PSA. |

**Accommodations:** Allow students who are lower to be at the level of a “2” for at standard rather than a “3.” Pair students in like level groups, or various level groups so they can help each other. Rather than leaving PSA medium open to students give them a specific one to use. Chunk the project into parts and have students incorporate a portion at a time.

**Extensions:** Require more of students, such as a paper on the Zika Virus from the lense of their “expert” group.

**Assessment:** Completed communication tool/ PSA, assessed via (L6) rubric

**References/Resources:**

(L6) Communication tool/PSA Planning Sheet Checklist

For graphical novels, comic strips, or animated video programs try: [www.pixton.com](http://www.pixton.com)

[www.animaker.com](http://www.animaker.com)

**Lesson 07: Share Communication Tool/PSA**

**Problem statement:** Your task is to create a communication tool/PSA educating potential travelers to Florida of the risk and/or precautions to take to minimize the chances of them catching and possibly spreading zika.

**Learning objectives:** Students will be able to present and take notes on others’ PSA.

**Lesson standards (NGSS, CCSS, CTE):**

NGSS Practices

8. Obtaining, evaluating, and communicating information

**Skills and Relevance:**

**Soft skills:** Problem-Solving, Critical Thinking, Evaluating a source, Productivity, Accountability, Leadership, Responsibility, Initiative/Self-direction

**Connections to career and educational pathways:** During this lesson students will learn about career and educational pathways from the other students groups during the presentation. This will allow the students to compare and contrast the different career and educational pathways.

**Materials:** (L7) Zika PSA Presentation Audience Note Sheet, (L7) Group and Peer Evaluation, completed PSAs.

**Lesson preparation:**

**Time required:** 52-104 mins.

**Grouping of students for instruction:**

Individual with the possibility of pairs.

**What is the instruction? Consider the PBL Procedure that is being addressed here:**

Depending on time and size of class students present via gallery walk, elevator speeches, etc… Students who are viewing analyze each other’s projects as well as reflecting on their own taking into account peer feedback/what they did already.

**Understanding the Problem**

|  |  |
| --- | --- |
| **Teacher** | **Student** |
| Observing presentations. | Presenting |
| Grading PSAs | Reflecting/viewing/analyzing their own and each others’ projects. |

**Accommodations:** Give students less questions such as only one key point instead of three, or have them focus on one type of feedback such as visual, viral mode of transmission, etc...

**Extensions:** Post it notes on gallery walks, have students respond to constructive feedback/comments.

**Assessment:** Grade completed PSA using rubric, look over/grade student notes on others’ PSAs.

**References/Resources:**

(L7) Zika PSA Presentation Audience Note Sheet, (L7) Group and Peer Evaluation

1. The sub-sections of the procedure section (e.g., Understand the Problem, Explore the Problem) are from the Illinois Math and Science Academy’s PBL Teaching and Learning Template, however, the descriptions were developed by WABS and do not necessarily represent the views of IMSA. [↑](#footnote-ref-0)