

Action Proposal
Middle School Interdisciplinary Science League of Justice: Emerging Pathogens Series
Lacretia Daly, 8th Grade Physical Science
Ocoee Middle School, Ocoee FL

Abstract: Science explains cycles of life processes and pathogens disrupt these cycles of life. Transmissions of pathogens disrupt life, and can result in epidemics of death. Case studies of emerging pathogens will allow students to construct motivation with emotional intelligence in caring about using scientific problem solving. Students model an integrated science team effort for interdisciplinary solutions. The middle school Interdisciplinary League of Justice (ISLJ) model collaborates applying scientific knowledge via case studies to connect literacy and problem-based learning connected to research careers. Investigations and WISE simulations modules will incorporate emerging pathogens research, mapping of epidemics, scientific labs, journaling and model scientific publications outcomes. Experiences from the University of Florida CPET CATALySES program and interdisciplinary curriculum content will incorporate 21st-century learning skills to correlate emerging pathogen research with biomedical careers and current science. Current science topics students examine and research of emerging pathogens are: Ebola, Wolbachia, Cholera, Shigella, and Keystone.

Rationale: The student population demographics indicate lower test scores in standardized ELA (English Language Arts) scores and higher scores on science standardized test scores. The vehicle of using science to increase higher performance with CPET teaching strategies will also increase critical reading proficiency with interdisciplinary approach. Additionally engaging students with hands on diverse modalities of learning complex science concepts will increase their recall abilities and application related synthesis of content in assessments. Instruction will construct meaningful learning for students to address this problem by modeling integrated curriculum with diverse disciplines of science. Lessons will combine emerging pathogens learning framework with laboratory experiments. Increasing types of audio, visual and sensory with an interdisciplinary approach will increase the recall processes for remembering about content applications. The series of emerging pathogens research is a vehicle of motivation and engagement of hands-on labs, building relevance to current science, and adds social learning via team-based learning and performance monitoring. The framework of this unit will use the Team-Based Learning Project (TBLP) to engage students in emerging pathogens modules. The outcome format will follow the scientific publishing sequence in identifying the problem, literature review, methodology, results, and analysis with recommendations to the problem.

Description of teaching unit: The nature of science standards and practice of science standards are used with current science curriculum to engage students in emerging pathogens for the practice of science. Students engage in learning lab safety, understanding problems, design and carrying out investigations, literacy skills from reading abstracts of research and modeling

technical writing for publication. Students will use emerging case studies and engage in methodology in lab experiments, analyzing data graphically and drawing conclusions with extensions and relevance. These standards are woven throughout the school year and the five days of lessons presents the initial format. Additional cases studies use equipment lockers to investigate emerging pathogens with genetic sequencing, PCR, gel electrophoresis and tests.

Interdisciplinary Science Standards:

SC.8N.1.1, Define a problem from the eighth-grade curriculum using appropriate reference materials to support scientific understanding, plan and carry out scientific investigations of various types, such as systematic observations or experiments, identify variables, collect and organize data, interpret data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions.

SC.8.N.1.2, Scientific inquiry is a multifaceted activity; The processes of science include the formulation of scientifically investigable questions, construction of investigations into those questions, the collection of appropriate data, the evaluation of the meaning of those data, and the communication of this evaluation.

SC.8.N.1.3, Scientific knowledge is based on observation and inference; it is important to recognize that these are very different things. Not only does science require creativity in its methods and processes, but also in its questions and explanations.

SC.8.N.1.5, Scientific argumentation is a necessary part of scientific inquiry and plays an important role in the generation and validation of scientific knowledge.

SC.8.N.1.6, Scientific argumentation is a necessary part of scientific inquiry and plays an important role in the generation and validation of scientific knowledge.

MAFS.8.F.2.5, Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.

SS.8.G.1, Use appropriate geographic tools and terms to identify and describe significant places and regions in American history.

CTE-HLTH.68.GENRL.0101, Compare medical progress from early times to the present (e.g. surgical techniques, anesthesia, treatment, and equipment).

CTE-HLTH.68.BIOTEC.01, Demonstrate an understanding of the biotechnology research and development career pathway.

Lesson Plan for Quarter 1 Implementation

Day 1~Students start with Personal Mind Mapping with the terms emerging pathogens and biomedical science careers.

Bellwork on Canvas: Students are introduced to pathogens with a video “What Exactly Does Cholera Do To Your Body?” <https://www.youtube.com/watch?v=Z1aydJ21ddk>

Cholera and the Nature of Science <https://np1.nearpod.com/presentation.php?id=42855146>

~A Nearpod presentation will address and collaborate student responses to the following.

1. How do pathogens travel?
2. What role does bacteria and viruses play in pathogens?
3. Why does finding a solution matter?
4. What are some organizations that work together to solve epidemics?
5. Give an example of two pathogens, data representation of the harm caused, and solutions.
6. Why is it important to communicate findings for global access to knowledge?

7. Post assessment
8. Assign homework survey on attitudes of research and science career interest. Reading of pathogen article.

Day 2. Science Take-out lesson on *Pathogens, antibodies and vaccines* (see link attached.)

<http://www.sciencetakeout.com/wp-content/uploads/2014/10/TEACHER-Pathogens-Antibodies-and-Vaccines-8-3-14.pdf>

1. Bellwork: Students will engage in the matching microbes group activity and share with the class and review lab safety rules
2. Graphing of epidemic data and analysis. Use interactive worksheet in teacher resource.
3. Journal reflections on the problem, research on transmission, methodology and data analysis
4. Team-based learning homework reading research abstract and assessment on TBL (See Attachment 1..)

Day 3: Lab day and interactive testing of cholera using Science Take-Out *A Medical Mystery*

<http://www.sciencetakeout.com/wp-content/uploads/2014/10/TEACHER-Medical-Mystery-7-31-11.pdf>

Day 4: Session 3 Application questions for lab safety and cholera used as a review with TBL

1. Contamination process simulation with shot cups solutions and acid/base indicator.
2. Group discussion on transmission of pathogens and prevention.
3. Introduce diseases caused by viruses and bacteria collaboration
4. Journaling prompt : Based on the evidence, describe how scientific data solves problems.

Day 5: Formal assessment of vocabulary, recall, application and critical thinking questions independently. Followed by drafting article of their experience on ISJL cholera as an emerging pathogen. Write a detailed paragraph describing how the integrated science careers team's efforts benefitted or delayed with the case study of the emerging pathogen.

Expected Outcomes:

1. The Integrated Science League of Justice will apply Team Based Learning Project principles to facilitate researching emerging pathogens and nature of science standards.
2. Students will use case studies to investigate a series of emerging pathogens and present their findings in a mock publication format.
3. Students will conduct mapping and use biostatistics to analyze the problem and transmission of pathogens to biomedical interdisciplinary careers.
4. Students use pre/post personal mind mapping as anticipation guides for emerging pathogens series studied.
5. Student teams will publish their experiences on emerging pathogens using a rubric that is self scored, team scored and community grade level scored as a science grade level. Presentations may be shared with other grade level classes.

UF CPET sessions used: Team based learning, Biostatistics, Epidemic Mapping, Science Take-Outs, Antibody resistance, PCR, Electrophoresis, Micro assay testing, and lectures.

Data Collection: Personal Mind Mapping, Science Take Out Labs, Journals, TBL, assessments

Use of equipment: Giant Microbes with Q/A cards, Pipetting Stations Locker, Advanced Gel Electrophoresis, ELISA locker, PCR

CPET Elements: Cholera, Ebola, Epidemic Mapping, Pipetting by design, Outbreak lab, Wolbachi, Denge Case Study, Team based learning, Lab safety

Budget and Budget Justification:

The following items are needed to differentiate concepts for students with literacy deficits as they learn complex concepts in science. The Science Take Out kits provide interactive testing support to literature for optimum connections.

Item	Vendor / Source	Cost
STO-133 Pathogens, Antibodies and vaccines	Science Take Out	36.22
STO-116 A Medical mystery of epidemic proportions	Science Take Out	45.68
STO-155 Treating dirty water	Science Take-out	18.90
STO- 134 Genetic Engineering	Science take out	23.10
STO 136 Disease Detectives	Science take out	27.30
211248 ELISA simulation	Carolina Biological	125.00
Pandemic Games	Amazon	35.99
Water Quality test Strips	Carolina Biological	19.59
Total		300.00

References

<http://www.teambasedlearning.org/recent-papers/>

<https://www.sabetilab.org/research/#infectious>

<https://qz.com/africa/1649974/drc-ebola-outbreak-evokes-memories-of-west-africa-crisis/>

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4663196/>

<https://www.cdc.gov/cholera/haiti/index.html>

McCormack, W.T. & Garvan, C.W. 2014, 'Team-Based Learning Instruction for Responsible Conduct of Research Positively Impacts Ethical Decision-Making', *Accountability in Research: Policies and Quality Assurance*, vol. 21, no. 1, pp. 34-49.

Cunha, M. L., Amendola, F., Samperiz, M. M., & Mohallem, A. G. (2018). Evaluation of student perception of the Team-based Learning method (APA-TBL): Instrument construction and validation. *Nurse Education in Practice*, 33, 141-147. doi:10.1016/j.nepr.2018.09.008

Attachment 1

Reading Comprehension for Literacy Skills

Read the following and answer the quiz independently. The TRAT will use the same questions but submitted as a team approach for grading.

Infect Ecol Epidemiol. 2015; 5: 10.3402/iee.v5.30048.

Published online 2015 Nov 27. doi: 10.3402/iee.v5.30048

PMCID: PMC4663196

PMID: 26615822

The consequences of human actions on risks for infectious diseases: a review

Johanna F. Lindahl, DVM, PhD1,2,* and Delia Grace, DVM, PhD1

Abstract

The human population is growing, requiring more space for food production, and needing more animals to feed it. Emerging infectious diseases are increasing, causing losses in both human and animal lives, as well as large costs to society. Many factors are contributing to disease emergence, including climate change, globalization and urbanization, and most of these factors are to some extent caused by humans. Pathogens may be more or less prone to emergence in themselves, and rapidly mutating viruses are more common among the emerging pathogens. The climate-sensitive vector-borne diseases are likely to be emerging due to climate changes and environmental changes, such as increased irrigation. This review lists the factors within pathogens that make them prone to emergence, and the modes of transmission that are affected. The anthropogenic changes contributing to disease emergence are described, as well as how they directly and indirectly cause either increased numbers of susceptible or exposed individuals, or cause increased infectivity. Many actions may have multiple direct or indirect effects, and it may be difficult to assess what the consequences may be. In addition, most anthropogenic drivers are related to desired activities, such as logging, irrigation, trade, and travelling, which the society is requiring. It is important to research more about the indirect and direct effects of the different actions to understand both the benefits and the risks.

Keywords: emerging infectious diseases, zoonoses, ecosystem changes, disease dynamics, food security, food safety

IRAT/ TRAT Quiz material

1. Which is not a contributing factor of disease emergence.
 - a. Climate change
 - b. Urbanization
 - c. anthropogenic change
 - d. Common cold
2. How do anthropogenic changes increase pathogens:
 - a) Directly b) indirectly c) Both.
3. True or False Anthropogenic drivers are required by society in population growth.
4. True or False Mutating viruses are decreasing in emerging pathogens.
5. Vector borne diseases are most affected by (irrigation or climate change).

Lesson Plan: Emerging Pathogens Cholera Attack

Title: Integrated Science League of Justice: Emerging Pathogens Series

Key questions:

1. What lab safety precautions are needed to protect science defenders against pathogens?
2. What types of scientific investigations could be used to understand the problem?
3. How does the integrated practice of science prevent pathogens from disrupting life as we know it?
4. How does knowledge of transmission assist in epidemic mapping?
5. How does historical tracking the history of the pathogen assist in hypothesizing solutions of defending against emerging pathogens?
6. How do current scientific theories, laws and biostatistics assist in analyzing defending using vaccinations?

Science Subject: Physical Science and Integrated Science

Grade and Ability Level: 8th grade (Regular and Advanced)

Science Concepts: Nature of Science, Practicing Science, Process of Living Systems, Properties of Matter, and Changes of Matter.

Overall Time Estimate: Lessons are taught in 55 minutes sections and require three to five days per quarter. This action plan will use one 3-5 days sessions per quarter.

Learning Styles: Team-based learning, visual, auditory and/or kinesthetic

Vocabulary: Emerging Pathogen, scientific method, cholera, epidemic mapping, vaccinations, genetic engineering, laws, theories, and hypothesis, observations, methodology, virus, bacteria, antibodies.

Lesson Summary: The lesson will cover a case study of cholera and interactive testing using the scientific method to analyze results of transmission in a journal format. Students will engage in team based learning with research literacy, immerse in lab testing to identify emerging pathogens, apply interdisciplinary solutions, and journal how their learning provided relevance and motivation to solve this case.

Student Learning Objectives with Standards:

Nature of Science:

N.1.1, N.1.2,N.1.3, N.1.5.,N.1.6

SS.8.G.1,

CTE-HLTH.68. BIOTEC.01,

CTR-HEALTH.68.HINFO.01

1. The student will be able to: engage in the practice of science with case studies that use lab experiments applying scientific investigations for emerging pathogens.
2. The student will research and use reading comprehension skills to processing solutions in a team based learning environment Interactions will address problem solving skills in scientific testing, analysis and completed assessments
3. The student will be able to graph the geography the epidemic and analyze the biostatistics.
4. The student will model health careers in health and current science for finding solutions to emerging pathogens case study.

Daly, Loretta - ISLJ Case Study on Cholera

5. The student will communicate findings using a format that expresses the problem, research, methodology, results and conclusions.

Materials:

“What Exactly Does Cholera Do To Your Body?”

<https://www.youtube.com/watch?v=Z1aydJ21ddk>

Cholera and the Nature of Science <https://np1.nearpod.com/presentation.php?id=42855146>

Science Take-out lesson on *Pathogens, antibodies and vaccines* (see link attached.)

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Science Take-Out *A Medical Mystery*

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Use of UF Equipment Lockers: Giant Microbes with Q/A cards, Pipetting Stations

Locker, Advanced Gel Electrophoresis, ELISA locker, PCR

Background Information: Background information needed are the scientific method, antibodies, vaccinations, pathogens and graphing data. Knowledge of testing lockers of case studies

Advance Preparation:

1. Access and load the NearPod presentation.
2. Organize the self testing kits for student groups
3. Canvas assignment of the research article
4. Canvas assignment for Team-based learning quiz for IRAT and TRAT with application guide questions
5. Maps and handouts of the epidemic with sticky notes
6. Canvas format for the periodical reporting with rubric

Procedure and discussion questions with time estimations

Extensions : How does genetic bioengineering use natural selection to defend against emerging pathogens in insects?

Copies of lesson materials:

See links embedded.

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<https://qz.com/africa/1649974/drc-ebola-outbreak-evokes-memories-of-west-africa-crisis/>

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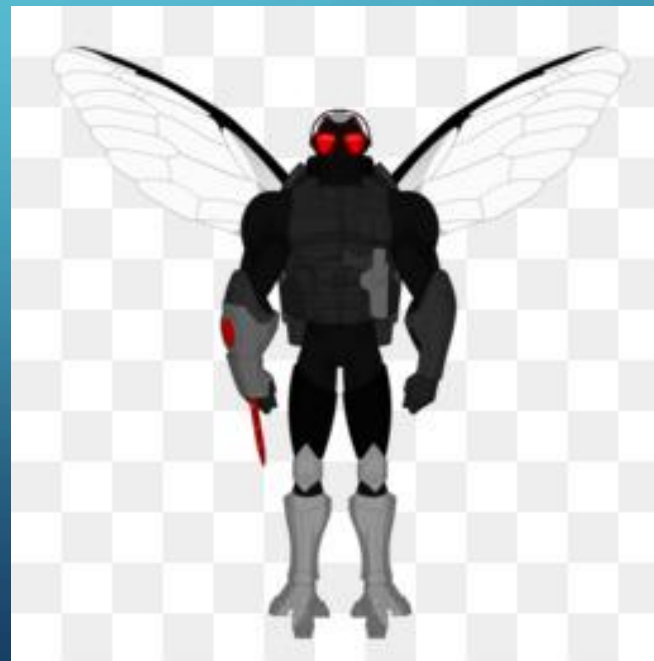
Cunha, M. L., Amendola, F., Samperiz, M. M., & Mohallem, A. G. (2018). Evaluation of student perception of the Team-based Learning method (APA-TBL): Instrument construction and validation. *Nurse Education in Practice*, 33, 141-147. doi:10.1016/j.nepr.2018.09.008

INTERDISCIPLINARY SCIENCE LEAGUE OF JUSTICE (ISLJ): THE EMERGING PATHOGENS SERIES

LACRETIA DALY

OCOEE MIDDLE SCHOOL

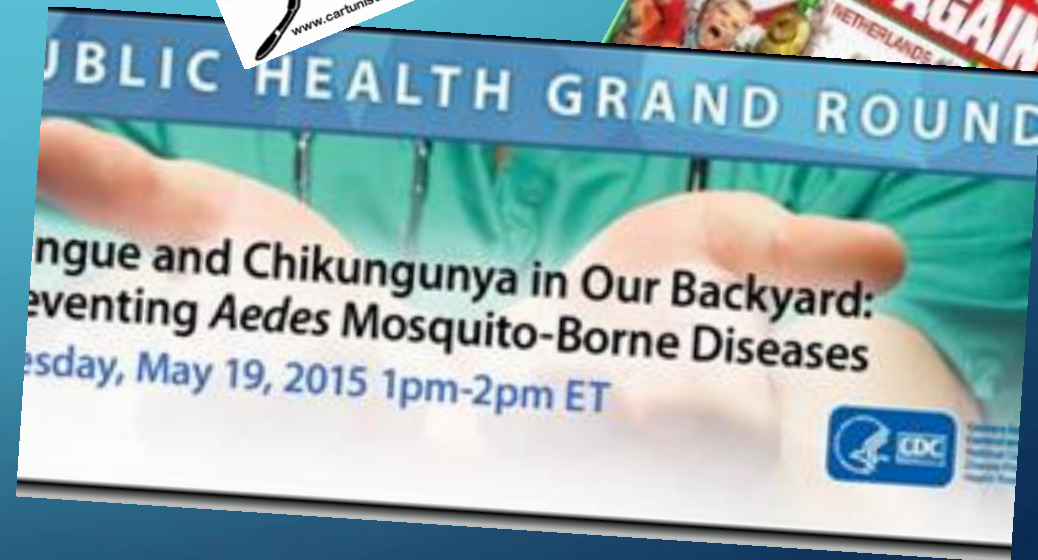
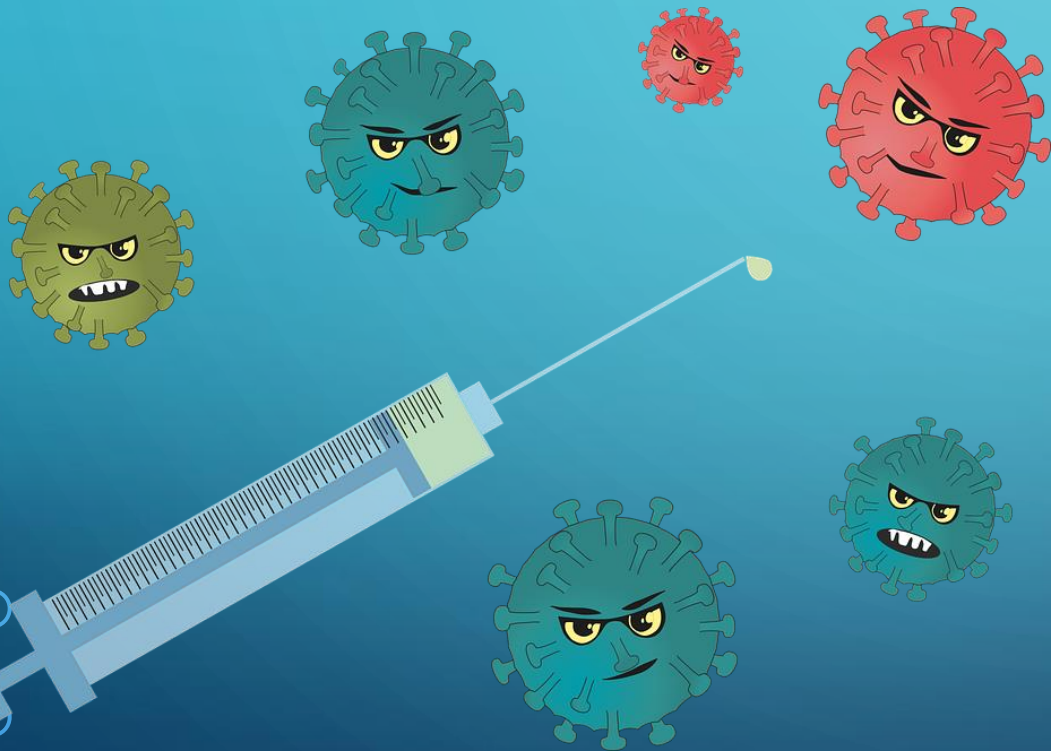
OCOEE, FLORIDA



ABSTRACT

Science describes life, yet pathogens can devastate life as we know it. Adversely, pathogens infiltrate societies globally causing epidemics and pandemics with emerging pathogens that kill millions with microbes. This adversarial role of pathogens motivates the Interdisciplinary Science League of Justice (ISLJ) to use interdisciplinary scientific applications to eradicate emerging pathogens. Biomedical justice is thematically implemented with Team-Based Learning while applying the nature of science and practice of science standards across-curriculum content. The ISLJ facilitates learning with current science case studies, literacy, research analysis, experimentations, and WISE performance assessments. The University of Florida CPET CATALySES program activities will be implemented into middle school science curriculum, which focuses on pathogens of plants, animals and humans. Modules will incorporate topics focused on: Ebola, Dengue, Cholera, Biotechnology, and Keystone. Labs will model real world cases that contribute to avenging epidemics of emerging pathogens while building 21st century skills and literacy skills for students.

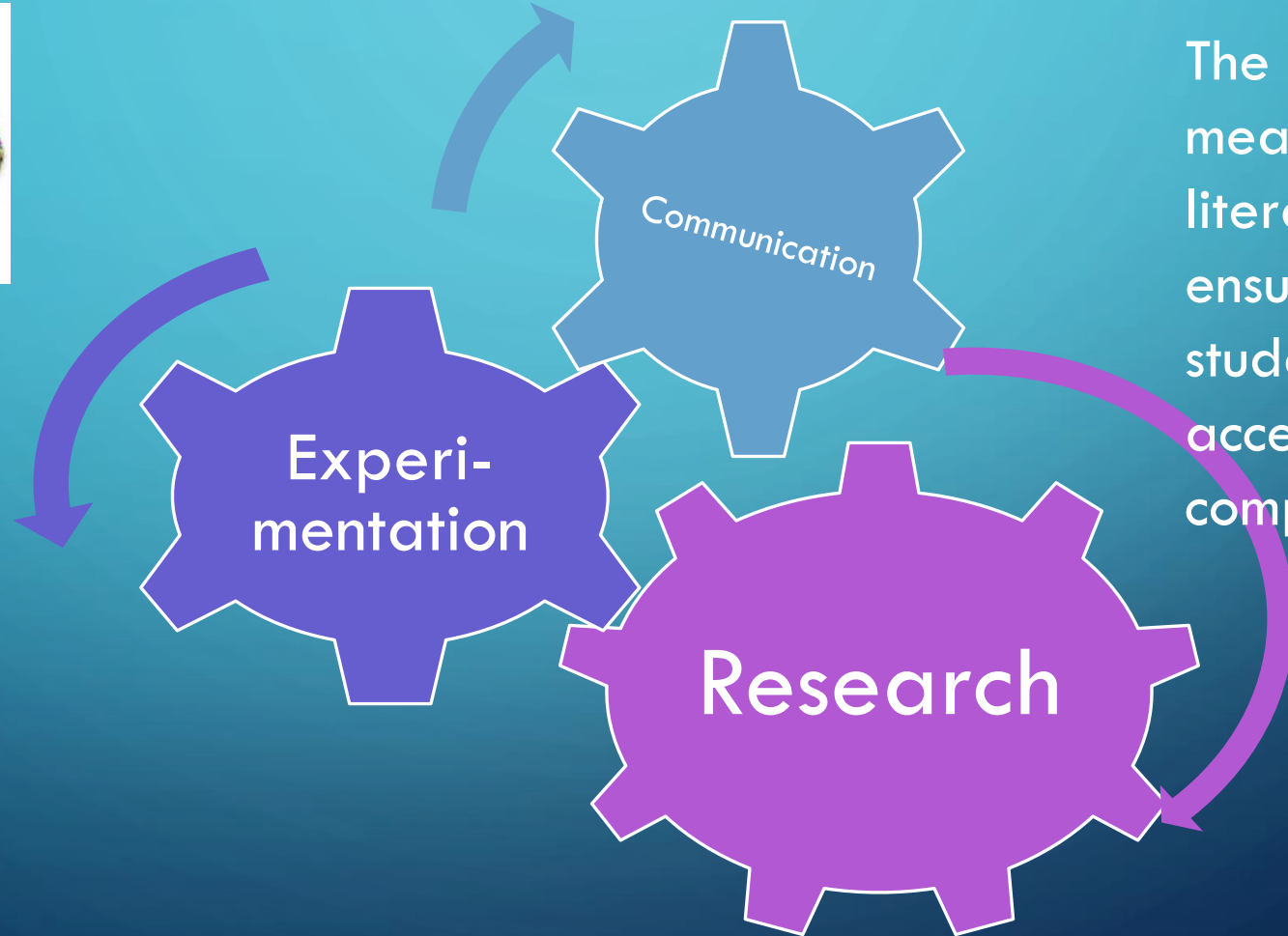
VACCINATIONS ARE EFFECTIVE IN PREVENTING EPIDEMICS UNTIL EMERGING PATHOGENS CHANGED LIFE AS WE KNOW IT.



CHANGE AGENTS OF THE ISLJ CASE STUDIES CHANGES MINDSETS THAT ALTER FUTURES FOR RESEARCH.




THE ISLJ PROVIDES AN INTERDISCIPLINARY APPROACH TO VIEWING SOLUTIONS TO EMERGING PATHOGENS



The benefit is to ensure meaningful learning and literacy in science that ensures that high school students are prepared to access science texts with comprehension.

RATIONALE

The Ocoee Middle School (OMS) student population represents **81% low-income**. English test scores were below the state average of 50%. However in **science, low income students scored above the state average** and within 3% of the state average 53% for all students. Therefore, science is a strength that students can be used to overcome their other interdisciplinary weakness.

- Challenges in reading comprehension affect OMS Hispanic students more, as this group scored **5% points below the state average for Hispanics. Other ethnic groups scored at or above the state average for Asian, Multicultural, Black and White students.** (greatschools.org) 
- Addressing the literacy challenge with science concepts, correlate to higher synthesis of content in assessments, and they become better prepared for science concepts in high school.

CASE STUDIES:
CHOLERA
EBOLA
DENGUE
WISE LABS
KEYSTONE



LITERACY WITH SCIENCE CASE STUDIES YIELDS

This action plan supports students constructing meaningful learning with **emotional intelligence** to address this problem. **Cultural competency** will develop conversations as young scientists unify knowledge for goodness. Lastly, increasing types of audio, visual and sensory with an interdisciplinary approach while **facilitating connections to biomedical careers**.



Team-Based
Learning™
Collaborative

Relevance

Motivation

Engagement

Higher

Performance

RATIONALE CONTINUED

- The communication will **correlate to language standards** as students comprehend and communicate their finding in mock publication format as a group. As students read scientific case studies they will interact with differentiated higher level reading comprehension .

DESCRIPTION OF TEACHING UNIT

The **nature of science standards SC.8.N.1.5** analyze the methods used to develop a scientific explanation as seen in different fields of science.

and the **practice of science standards** as a way to explain the natural world in practices and historical accumulation of knowledge.

- Students integrate biomedical experiments into epidemic related case studies. The interactive lessons engage students in scientific investigations and critical thinking to save lives from devastating pathogens applying the practice of science.
- Students engage the scientific method while learning lab safety, pipetting skills, identifying real life problems, analyze scientific literature, conduct methodology, collect data, analyze and draw conclusions.

THE INTEGRATED SCIENCE LEAGUE OF JUSTICE

EXPECTED OUTCOMES

- Case studies with **WISE** and Team Based Learning to facilitate researching emerging pathogens in nature of science standards.
- Students will conduct **lab experiments** using pipetting skills, PCR, electrophoresis, ELISA testing, antigen/antibody aggregation and present their findings in a mock publication format.
- Students will conduct epidemic mapping, **use biostatistics** to analyze the problem and transmission of pathogens.
- Student teams will **publish their experiences** on emerging pathogens using a rubric that is self scored, team scored and community grade level scored as a science grade level. Presentations may be shared with other grade level classes.



*web-based inquiry
science environment*

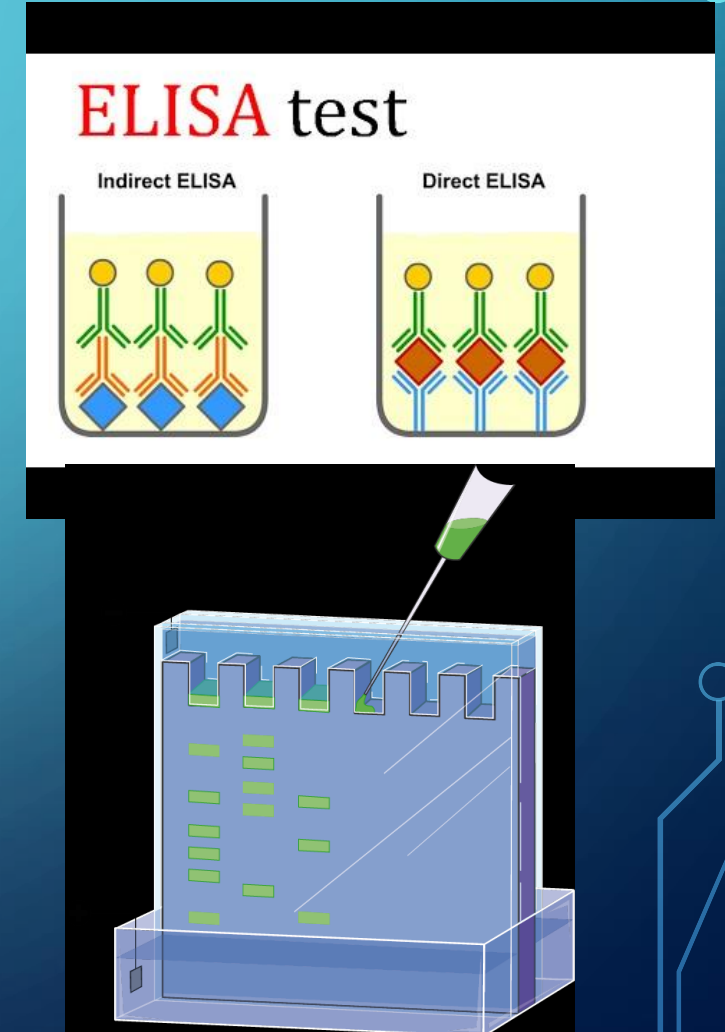
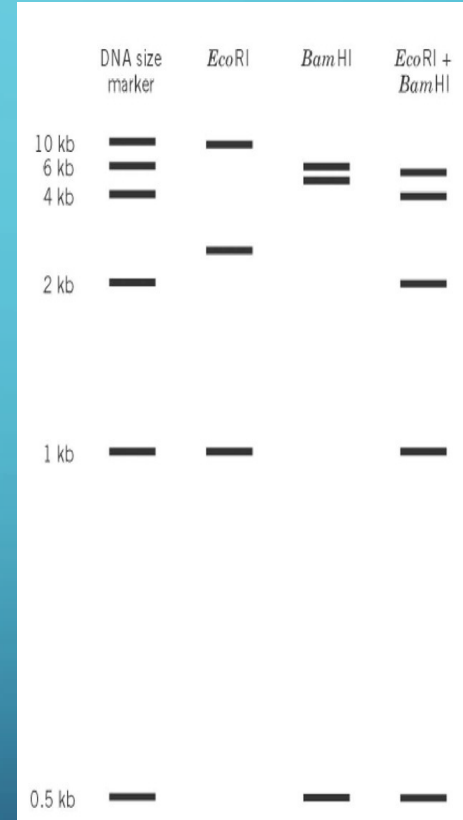
DATA COLLECTION TECHNIQUES AND/OR STUDENT ASSESSMENTS

- Data of student attitudes of careers in science
- Performance of using lab skills in testing for emerging pathogens.
- Assessments of WISE case study lessons
- Student journals and group publications
- Common assessments of standardize science performance
- Groups forums of post survey and reflections of group publications

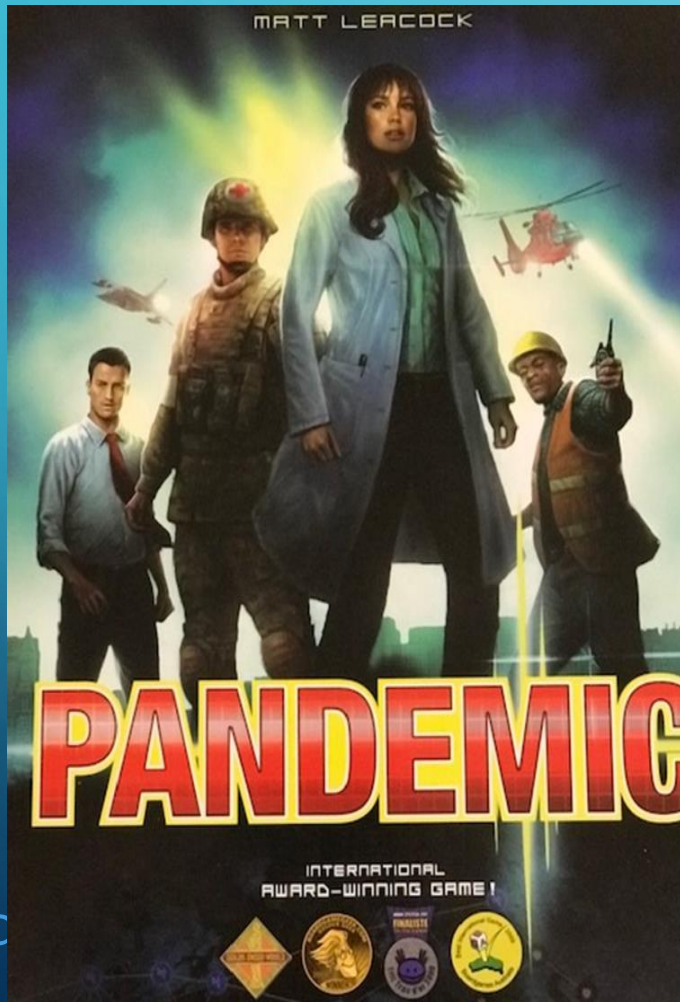


IF APPLICABLE, USE OF EQUIPMENT LOCKERS AND/OR UF VISIT (EITHER IN THE CLASSROOM OR UF CAMPUS)

- Pipette by Design
- Dengue/ELISA test simulation
- PCR/Gel Electrophoresis
- Antigen/ antibody reaction
- Microbes stuffed animals
- Take out science epidemic
- Team-based learning cards



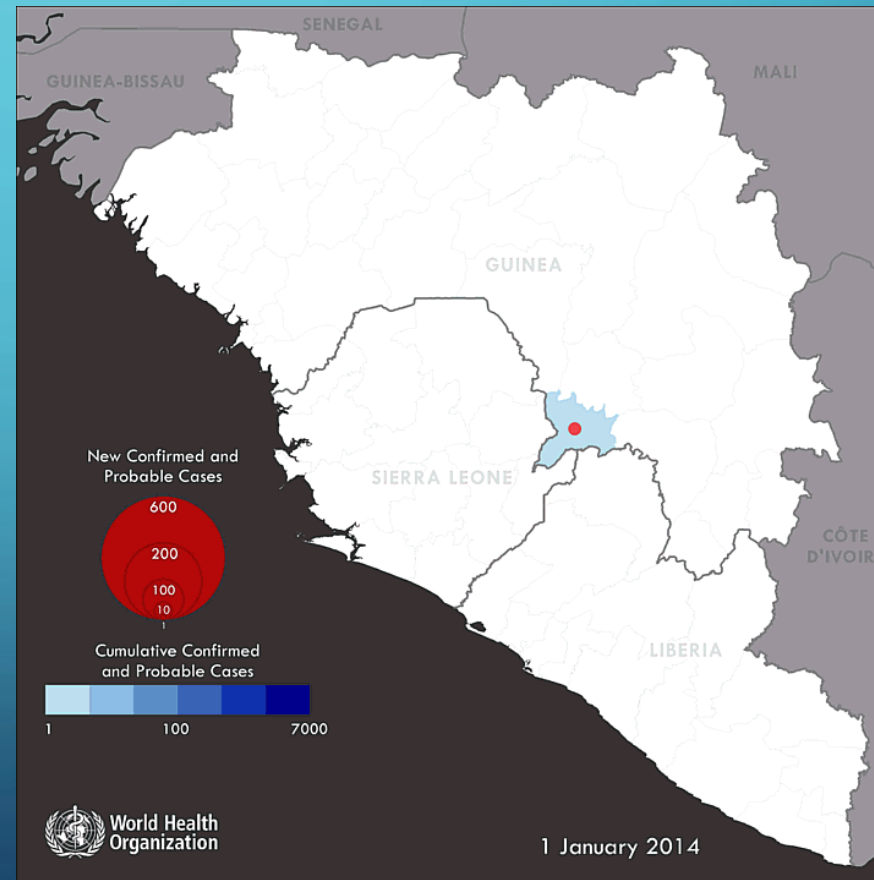
PARADIGM SHIFT IN PEDAGOGY



- How your proposal differs from what you normally teach, new pedagogies; how you previously taught this lesson or topic versus how you plan to teach it under your Action Proposal
- My classes typically follow a weekly format of note taking, textbook inquiry, lab , review games and quiz for the week. Students work independently and collaboration is limited to labs and review. Cloze reading is the primary support for literacy.
- However, this action plan will use case studies for real world relevance. Justice is thematically applied to avenging destructive pathogens . Increase **interactive literacy and comprehension with WISE assessments.** Students have more relevance to concepts as **team based learning in problem solving.**
- Students' exposure to research careers are connected with lab testing will model CPET experiments in diagnosis and treatment of epidemic resolutions.

CATALYSES ELEMENTS IMPLEMENTED

- Case studies regarding : Dengue, Ebola, Shigella, Keystone, and Cholera
- Team based learning
- PCR/ electrophoresis
- ELISA testing
- Antigen/Antibody reaction
- Pipette by design
- WISE
- Epidemic mapping
- Virus Microbes stuffed animals



WORKS CITED

- WISE – The Web-based Inquiry Science Environment. <http://wise.Berkeley.edu>
- Greatschools.org Ocoee Middle
- Literacy for Science: Exploring the Intersection of the Next Generation Science Standards and Common Core for ELA Standards: A Workshop Summary (2014) Chapter 2 Literacy for Science in English Language Arts and Science Standards. The National Academy of Sciences Engineering Medicine.
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QUESTIONS

