Theme

How can citizens innovate, manage, and use technology in ways that are socially responsible?

STEM Innovation Academy Unit 3 Plan

Subject: Principles of Biomedical Science Unit Title: Outbreaks and Emergencies Grade: 9	Teacher: Macri Duration: 8 weeks

Summary of Unit
Unit 3 introduces students to various types of emergencies that can occur and different strategies to assess and resolve them. In Lesson 1 (9-10 blocks), students are tasked with identifying the source of an outbreak of an infectious disease in a hospital. They must analyze patient, staff, and hospital information to determine the likely source of the infection. They will then use aseptic technique to isolate and gram stain the infectious agent to identify it. In Lesson 2 (9-10 blocks), students take on the roles of emergency first responders. They are called to assist a hiker who has been injured in the woods. They must address the hiker's injuries, stabilize her, and bring her to safety. They will then analyze decisions that have to be made when triaging multiple patients and dealing with medical surges in an emergency department. The lesson will culminate with students designing a mobile medical facility that can be used to better serve the public. In Lesson 3 (3-4 blocks), students analyze and design apps that can be used to help individuals in circumstances of public health emergencies.

Stage 1 – Desired Results
Standards/Outcomes/ PARCC Related items: NGSS and CCSS standards covered in each lesson included in the following link: https://drive.google.com/file/d/1hUgD4cfwwrXHu3YlKGdX-amU4qy0ZqNB/view?usp=sharing

Essential Questions:

Unit 1 lesson 1
1. In what ways, and for what purpose, can microorganisms be characterized?
2. What factors affect the growth and death of microorganisms?
3. What are effective strategies for preventing and treating disease?
4. How does an immune system identify and eradicate infection?
5. How can pieces of evidence be evaluated to form conclusions and inform decisions?

Unit 1 lesson 2
1. How can an individual's health status be assessed and evaluated?
2. How is patient case information summarized and communicated efficiently?
3. What professions respond in emergency situations, what are their roles, and how do they work together?
4. What are several career paths in the field of emergency medicine?
5. How do patient vitals and presumptive diagnoses inform the prioritization for treatment options in emergency medical situations?
6. What make for effective emergency and disaster response protocols?
7. How do medical professionals manage emergencies that involve multiple patients?
8. To respond to emergency situations, what common medical resources and facilities need to be available?

Unit 1 lesson 3
1. What are features of a user-friendly app?

2.	In what ways can technology enable a faster response and quicker resolution during medical emergencies?

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Stage 2 – Assessment Evidence

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Unit Pre-Assessment:

1. Pathogen case study: students will read about an infection outbreak and must predict the type of pathogen responsible for infections and its properties. This will be used to assess prior knowledge and preconceptions before Lesson 1.
2. Fictional emergency storyline: students will write a script for a medical emergency and indicate the individuals involved in addressing the situation and their respective roles. This will be used to assess prior knowledge and preconceptions before Lesson 2.

Performance Task(s):

*Science Journal: Students will be responsible for maintaining a Science Journal throughout the unit in which they include career connections, ethical discussions, procedures for new lab skills they learn, patient recommendations, lab reports, data, charts, diagrams, and models that are relevant to the unit.

*Career Journal Entries: At various points throughout the unit, students research and report on professionals involved in the case of Anna Garcia (EMT, blood spatter analyst, crime scene investigator etc.) They must find reliable APA cited sources, document the training required/ daily responsibilities, and write a reflection on their personal interest in the career and why.

Lesson 3.1: Nosocomial Nightmare
*Herd Immunity Simulation: Students will simulate herd immunity using NetLogo Modeling Commons. They will use the software to change several parameters, such as the number of people, the infectiousness, the duration, etc., and chart/graph the resulting data. They will answer analysis questions about what they observed.

*Bacterial Isolation Lab: Students will use aseptic technique to complete a quadrant streak plate of various bacterial samples in order to isolate the strain of interest. They will submit a lab report, including hypothesis, data, analysis, and conclusions.

* Gram Stain Lab: Students will perform a Gram stain on the bacterial culture previously isolated in order to further identify it. They will submit a lab report, including hypothesis, data, analysis, and conclusions.

*Transmit the Tale Podcast: Students will create a podcast outlining the outbreak that has occurred at GNMH and the steps taken to resolve it. They will discuss both the chain of events that occurred leading to the outbreak along with the tests and analyses they performed in order to identify it. Students will also include recommendations for strategies that can be used to limit future outbreaks.

Lesson 3.2: Emergency Response
*Saline Switch-Up Lab: Students will perform an investigation to determine the effect of placing a cell into hypotonic, hypertonic, and isotonic solutions. They will submit a lab report, including hypothesis, data, analysis, and conclusions.

*Medical Surge Game: Students will be given a regional map, game scenario, and a limited number of resources. They must set up their map and use the resources to treat as many patients as possible in the most efficient way. They will then answer analysis questions about the activity and draw conclusions about how medical surges affect hospital operations and patient care.

*Mobile Medical Facility Design and Presentation: Students will design a plan for a mobile medical facility and will present to the class. Their projects will include blueprints for the facility, a staffing plan, a list of equipment and resources available, a discussion of the medications that will be stocked, and a description of a mock emergency situation.

Lesson 3.3: Information Sharing
*Public Health Emergency App Design: Students will identify and analyze a real-world problem in the field of public health. They will design an app which addresses the problem they have selected. They will use the principles of user-centered design and universal design when creating the form and function of the app. They will present their app design plans to their classmates and revise based on peer feedback.

Authentic Experiences:
*Laboratory activities: bacterial isolation, Gram staining, microscopy
*Simulations of herd immunity and medical surges
*Application of tourniquet
*Triage of patients in medical emergencies
*Connection to COVID-19 pandemic

Extensions (Tier I):	Differentiation (Tiers 2 and 3)
- Experimental critique extended with more complex examples - Analysis of sources of error and limitations of investigations - Additional case studies related to real-world pandemics such as COVID-19, swine flu, and the Spanish flu - Analysis of whether outbreaks could occur in other species - Consider the effect of antibiotic resistance on outbreaks - Additional parameters in herd immunity and medical surge simulations	- Group work - Feedback on pre-labs prior to start of labs - Study skills (studyblue.com, study guide questions, Frayer model notecards, playposit.com) - Options for potential research websites provided - Chunked assignment with embedded checkpoints - Checklists with added conferences with teacher

Stage 3 – Learning Plan

Principles of Biomedical Science: Unit 3 Digital Access (Password Required):
https://pltw.read.inkling.com/a/b/d47610f05df0403b90d9d82f476be45e/p/5f04c4f79722460eae84519f9950fe42

Vocabulary

• Epidemiologist	• Antigen	• Gram stain
• Nosocomial	• User interface	• Solution
• Infection	• T-cell	• Solvent
• Host	• B-cell	• Solute
• Disease	• Antibody	• Osmosis
• Pathogen	• Immunity	• Homeostasis
• Prion	• Vaccine	• Isotonic
• Virus	• Simulation	• Hypotonic

• Bacterium	• Etiology	• Hypertonic
• Protest	• Metabolize	• Platelet
• Fungus	• Aseptic technique	• Triage
• Helminth	• Coccus	• App
• Innate	• Bacillus	• End user
• Acquired	• Spirillum	

Extensions: Expert/Field Experience(s)
Potential guest speakers: Epidemiologist, microbiologist, EMT, paramedic, emergency medicine physician Potential field trips: emergency room, hospital

Literacy Connections/Research
- Formal case/lab reports - Career journal entries - Ethics Analysis - Evidence analysis activities - App design activity

Modifications

Special Education/504:	**English Language Learners:**
-Adhere to all modifications and health concerns stated in each IEP. -Accommodate Instructional Strategies: reading aloud text, graphic organizers, one-on-one instruction, class website (Google Classroom), handouts, definition list with visuals, extended time -Provide breaks between tasks, use positive reinforcement, use proximity -Assure students have experiences that are on the Concrete- Pictorial- Abstract spectrum by using manipulatives -Implement supports for students with disabilities (click here) - Make use of strategies imbedded within lessons -Common Core Approach to Differentiate Instruction: Students with Disabilities (pg 17-18)	- Use manipulatives to promote conceptual understanding and enhance vocabulary usage - Provide graphic representations, gestures, drawings, equations, realia, and pictures during all segments of instruction - Utilize graphic organizers which are concrete, pictorial ways of constructing knowledge and organizing information - Utilize program translations (if available) for L1/ L2 students - Reword questions in simpler language -Scaffolding instruction for ELL Learners -Common Core Approach to Differentiate Instruction: Students with Disabilities (pg 16-17)
Gifted and Talented:	**Students at Risk for Failure:**
- Elevated contextual complexity - Inquiry based or open ended assignments and projects	- Assure students have experiences that are on the Concrete- Pictorial- Abstract spectrum

- More time to study concepts with greater depth
- Promote the synthesis of concepts and making real world connections
- Provide students with enrichment practice that are imbedded in the curriculum such as:
    ● Application / Conceptual Development
    ● Are you ready for more?
- Provide opportunities for science competitions
- Alternative instruction pathways available
	- Modify Instructional Strategies, reading aloud text, graphic organizers, one-on-one instruction, class website (Google Classroom), inclusion of more visuals and manipulatives, Peer Support
	- Parental/ guardian contact
	- Provide academic contracts to students & guardians
	- Create an interactive notebook with samples, key vocabulary words, student goals/ objectives.
	- Plan to address students at risk in your learning tasks, instructions, and directions. Anticipate where the needs will be, then address them prior to lessons.
	-Common Core Approach to Differentiate Instruction: Students with Disabilities (pg 19)

21st Century Life and Career Skills:

Career Ready Practices describe the career-ready skills that all educators in all content areas should seek to develop in their students. They are practices that have been linked to increase college, career, and life success. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

https://www.state.nj.us/education/cccs/2014/career/9.pdf

● **CRP1**. Act as a responsible and contributing citizen and employee. ● **CRP2**. Apply appropriate academic and technical skills. ● **CRP3**. Attend to personal health and financial well-being. ● **CRP4**. Communicate clearly and effectively and with reason. ● **CRP5**. Consider the environmental, social and economic impacts of decisions. ● **CRP6**. Demonstrate creativity and innovation.	● **CRP7**. Employ valid and reliable research strategies. ● **CRP8**. Utilize critical thinking to make sense of problems and persevere in solving them. ● **CRP9**. Model integrity, ethical leadership and effective management. ● **CRP10**. Plan education and career paths aligned to personal goals. ● **CRP11**. Use technology to enhance productivity. ● **CRP12**. Work productively in teams while using cultural global competence.

Students are given an opportunity to communicate with peers effectively, clearly, and with the use of technical language. They are encouraged to reason through experiences that promote critical thinking and emphasize the importance of perseverance. Students are exposed to various mediums of technology, such as digital learning, calculators, and educational websites.