Theme

Better Judgment and Character Through Science

STEM Innovation Academy Unit 1 Plan

Subject: Medical Interventions Unit Title: How to Fight Infection Grade: 11th	Teacher: Mr. Mojtaba Kahn Duration: 8 weeks (September 8 October 30)

Summary of Unit

In Unit 1, students will be exposed to interventions involved in detecting, fighting, and preventing an infectious disease as they investigate a potential outbreak at a fictitious college. Students will follow the story of Sue Smith, a fictitious freshman in college, who is not feeling well. Students will use various techniques and technologies to diagnose Sue and determine the source of the disease on campus, by creating a contact map. They will analyze clues found in the history and physical of each possible patient, identify pathogens present in body fluids through DNA sequence analysis, and test for the infectious agent using the antibody-based enzyme-linked immunosorbent assay (ELISA). Students will be introduced to the field of bioinformatics as they explore genetic databases to identify known gene sequences. They will also review principles of human immunity as they learn how antibodies can be used to identify the presence of a disease agent. At the conclusion of the investigation, students will outline a plan to stop a potential outbreak on campus and discuss interventions such as antibiotic therapy and vaccination, two topics to be explored in greater detail in the subsequent lessons.

Standards/Outcomes/ PARCC Related items:

NGSS standards covered in each lesson

DCI - LS1.A - From Molecules to Organisms: Structures and Processes - Structure and Function
Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1)

DCI - LS1.A - From Molecules to Organisms: Structures and Processes - Structure and Function
Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level. (HS-LS1-2)

DCI - LS1.A - From Molecules to Organisms: Structures and Processes - Structure and Function Feedback mechanisms maintain a living system's internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) or discourage (negative feedback) what is going on inside the living system. (HS-LS1-3)

DCI - LS1.C - From Molecules to Organisms: Structures and Processes - Organization for Matter and Energy Flow in Organisms
The sugar molecules thus formed contain carbon, hydrogen, and oxygen: their hydrocarbon backbones are used to make amino acids and other carbon-based molecules that can be assembled into larger molecules (such as proteins or

DNA), used for example to form new cells. (HS-LS1-6)

DCI - LS1.C - From Molecules to Organisms: Structures and Processes - Organization for Matter and Energy Flow in Organisms
As matter and energy flow through different organizational levels of living systems, chemical elements are recombined in different ways to form different products. (HS-LS1-6), (HS-LS1-7)

HS.LS1.2 - From Molecules to Organisms: Structures and Processes
Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

HS.LS1.3 - From Molecules to Organisms: Structures and Processes
Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

HS.LS1.6 - From Molecules to Organisms: Structures and Processes
Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.

DCI - PS1.A - Matter and Its Interactions - Structure and Properties of Matter
Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons. (HS-PS1-1)

DCI - PS1.A - Matter and Its Interactions - Structure and Properties of Matter
The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states. (HS-PS1-1)

DCI - PS1.A - Matter and Its Interactions - Structure and Properties of Matter
A stable molecule has less energy than the same set of atoms separated; one must provide at least this energy in order to take the molecule apart. (HS-PS1-4)

DCI - PS3.A - Energy - Definitions of Energy
Energy is a quantitative property of a system that depends on the motion and interactions of matter and radiation within that system. There is a single quantity called energy due to the fact that a system's total energy is conserved, even as, within the system, energy is continually transferred from one object to another and between its various possible forms. (HS PS3-1), (HS-PS3-2)

DCI - PS3.A - Energy - Definitions of Energy
At the macroscopic scale, energy manifests itself in multiple ways, such as in motion, sound, light, and thermal energy . (HS PS3-2), (HS-PS3-3)

DCI - PS3.B - Energy - Conservation of Energy and Energy Transfer
Uncontrolled systems always evolve toward more stable states— that is, toward more uniform energy distribution (e.g., water flows downhill, objects hotter than their surrounding environment cool down). (HS-PS3-4)

HS.ETS1.1 - Engineering Design
Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.

HS.ETS1.3 - Engineering Design
Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

DCI - ETS1.B - Engineering Design - Developing Possible Solutions
When evaluating solutions, it is important to take into account a range of constraints, including cost, safety , reliability , and aesthetics, and to consider social, cultural, and environmental impacts. (HS-ETS1-3)

DCI - ETS1.C - Engineering Design - Optimizing the Design Solution
Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed. (secondary to HS-PS1-6)

NJSLS standards covered in each lesson:
-NJSLSA.R1. Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
-NJSLSA.R2. Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.
-NJSLSA.R3. Analyze how and why individuals, events, and ideas develop and interact over the course of a text.
Integration of Knowledge and Ideas
-NJSLSA.R7. Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.
-NJSLS.R8. Delineate and evaluate the argument and specific claims in a text, including the validity of the reasoning as well as the relevance and sufficiency of the evidence.
-NJSLSA.R9. Analyze and reflect on how two or more texts address similar themes or topics in order to build knowledge or to compare the approaches the authors take.
- NJSLSA.R10. Read and comprehend complex literary and informational texts independently and proficiently with scaffolding as needed.

Career & Technical Education (CTE) Content Area: 21st Century Life and Careers Standards

-9.3.HL-BRD.1 Summarize the goals of biotechnology research and development within legal and ethical protocols.
-9.3.HL-BRD.2 Apply the fundamentals of biochemistry, cell biology, genetics, mathematical concepts, microbiology, molecular biology, organic chemistry and statistics to conduct effective biotechnology research and development of products.
-9.3.HL-BRD.3 Demonstrate basic knowledge of recombinant DNA, genetic engineering, bioprocessing, monoclonal antibody production, nanotechnology, bioinformatics, genomics, proteomics and transcriptomics to conduct biotechnology research and development.
- 9.3.HL-BRD.4 Demonstrate the principles of solution preparation, sterile techniques, contamination control, and measurement and calibration of instruments used in biotechnology research.
-9.3.HL-BRD.5 Determine processes for product design and production and how that work contributes to an understanding of the biotechnology product development process.
-9.3.HL-BRD.6 Summarize and explain the larger ethical, moral and legal issues related to biotechnology research, product development and use in society.

Stage 1 – Desired Results

Essential Questions:

Unit 1 Lesson 1

1. What are medical interventions?
2. What evidence helps scientists determine the source of a potential outbreak of an infectious disease?
3. What factors speed up or slow down the spread of disease through a population?
4. How has advanced technology, such as bioinformatics, changed disease detection?

Unit 1 lesson 2

1. Why are certain classes of antibiotics prescribed to treat specific bacterial infections?
2. Why can bacterial cells transfer genes from one bacterial cell to another and why is this important?
3. How has the development of antibiotics impacted human health?
4. What actions are humans taking that are contributing to bacteria becoming resistant to commonly used antibiotics?

Unit 1 Lesson 3

1. How does dysfunction in human anatomy relate to different types of hearing loss?
2. How is hearing loss diagnosed?
3. How is the type of hearing loss related to options for treatment?
4. What are the bioethical concerns related to the use of cochlear implant technology?

Unit 1 Lesson 4

1. How do vaccines aid the immune system in fighting off infection?
2. How has vaccination impacted disease trends locally and globally?
3. Why are plasmids important tools in genetic engineering?
4. What role do epidemiologists play in the detection, prevention, and treatment of both chronic and infectious disease?

Enduring Understandings

1. Medical interventions are any method or tool that allows scientists to diagnose, treat, cure, or prevent medical issues. Medical interventions provide a foundation for developed societies and are continually developed through science.
2. Close contact through living, working, or speaking close together can increase the rate of transmission. Epidemiologists can trace the source of an outbreak through contact mapping – backtracking the spread by learning about who felt what symptoms, when.
3. Bioinformatics is the growing field that combines computer technologies with biology, most commonly for databasing genetic information. Using bioinformatics, scientists can diagnose pathogens based on their DNA found inside of a patient.

4. Different antibiotics work by hindering certain mechanisms inside of bacteria or funguses. These are chemicals which can inhibit different classes of enzymes such as those that replicate bacterial DNA or construct their cell membranes.
5. Bacteria can transfer DNA between one another. This has the evolutionary advantage of increasing genetic diversity among the colony and thus, becoming more adapted to the local environment. However, this can also increase the rate at which bacteria become antibiotic resistant.
6. Over the last century, antibiotics have had an invaluable effect on human health and medicine. For example, before antibiotics a simple scratch could lead to a deadly infection,
7. Humans overprescribing and misusing antibiotics has led to an antibiotic crisis. When people take them when they don't need them, or don't use them as directed, more and more bacteria are becoming resistant to them. It is predicted that, in the near future, antibiotics may no longer work at all.
8. Dysfunction in certain parts of the ear will affect the type of hearing loss. Conductive hearing loss is affected by dysfunction of the outer and middle ear and can be helped with hearing aids. Inner ear problems, such as "dead" hair cells in the cochlea would require cochlear implants.
9. Hear loss is diagnosed by audiologists conducting an audiogram. Sounds of different volumes, pitches, and placement (near the ear, in the ear, on the skull) can diagnose hearing loss.
10. There are different kinds of vaccines but all work in similar ways of introducing an antigen (or similarly acting particle) of the pathogen, or a weakened form of the pathogen to the body. The immune system can recognize and build up antibodies that identify the pathogen, without the risk of being harmed by the pathogen. If, in the future, the body is exposed to a live pathogen, the antibodies will already be in sufficient enough numbers that the immune system senses and destroys the invasion.
11. Vaccinations are one of the wonders of modern medicine. Entire diseases like smallpox have wiped out due to vaccines and are another foundation in modern medicine and developed societies.
12. Plasmids are small loops of bacterial DNA that can be engineered to hold a gene to produce a protein of scientist's choosing. When placed back inside of a bacterium, using biotechnology, the bacteria will grow a colony of billions of bacteria, each with the special gene. This allows the bacteria to act like little protein factories to produce the protein of interest – one of which might be an antigens for a vaccine.

Stage 2 – Assessment Evidence

Unit Pre-Assessment:

Students complete a diagnostic test assessing success and retention of topics in past courses including structure and function of DNA, protein synthesis, antibody/antigen dynamics, and anatomy and physiology or major organ systems.

In addition, students will be given the opportunity to hypothesize the diagnosis of "Sue's" disease and contact trace before learning the proper analytical tools and methods.

Performance Task(s):

PLTW 1.1.1 What are Medical Interventions?
Students generate a list of medical interventions and then organize their lists into categories. Each category is defined and given examples.

PLTW 1.1.2 Mystery Infection
Students will analyze information presented in the Student Resource Sheet and will use the internet to generate a list of possible infectious agents and/or diseases that might be linked to patient symptoms. Students will document and describe how they came to their initial conclusions. Students will narrow down this list of potential pathogens as they receive more evidence and complete laboratory tests. Students will practice contact tracing by creating a flow chart or graphic organizer that illustrates the relationships between all of the patients in the outbreak case. This document will be updated as the case progresses and will be used later in the lesson when the students are asked to deduce how each infection may have spread from person to person

PLTW 1.1.3 Using DNA to Identify Pathogens
Students will explore one method used to sequence DNA to diagnose the mystery infection. Using different videos and materials, students will understand the process of Cycle Sequencing and complete a task to determine a DNA sequence based on the output graph of the cycle sequencer. Then students will run a BLAST using an online database and software to identify the species of the DNA they sequenced.

PLTW 1.1.4 Serial Dilutions
Students will devise a way to determine the concentration of dye in a container of water. To succeed, students must first learn how to properly create and calculate serial dilutions (a series of test tubes with weaker and weaker concentrations of the solute). By creating a series of dilutions, students will be able to, at least, confine the possibility of the mystery concentration to within 2 known serial dilution quantities.

PLTW 1.1.5 ELISA

In this lab, students will use ELISA to test simulated cerebral spinal fluid (CSF) samples taken from patients at Sue's school for the presence of bacterial meningitis. This rapid test can be completed in less than one hour and can detect antigens of the *Neisseria meningitidis* bacteria. Students' goal is to determine which college students are infected with the deadly bacterium and to propose a strategy for halting further spread. Students will run the assay and compare the results to known controls to determine the level of concentration of the antigens in the patient sample. This will allow students to infer how long ago the patient was infected and allow students to revise their contact trace maps. Furthermore, students must create graphical models to explain the theory behind how the ELISA works but also must conduct the experiment correctly to demonstrate proper application of the assay.

PLTW 1.1.6 Final Diagnosis
Students run another BLAST to diagnose all remaining patients using pathogen DNA provided in PLTW. Students create a final report that summarizes their findings for the whole lesson. This report should demonstrate how all of the evidence worked together to solve the case and should include a summary of the plan to address this outbreak on campus. Students can include theories for how the disease spread as well as possible connections for the spread of illnesses other than bacterial meningitis.

PLTW 1.2.1 Antibiotic Therapy
Students review bacterial structure, investigate various types of antibiotics and their mode of action against the bacteria they target, and suggest an antibiotic treatment for Sue Smith. Students will draw and label diagrams of bacterial anatomy and physiology and label the mechanisms for how different antibiotics work.

PLTW 1.2.2 Which antibiotic works the best?

When a patient is diagnosed with a bacterial infection, the physician will often take a sample of the bacteria from the infection site and test several different antibiotics to find the best one to use. In this performance task, students will be completing the same one performed daily in hospitals to find the most effective antibiotic to treat an infection. Students will test several different antibiotics to determine which one is the most effective at preventing the growth of a strain of bacteria.

PLTW 1.2.3 Attack of the Superbugs

In this activity, students will investigate the mechanisms by which DNA from one bacterial cell is transferred to another bacterial cell. When the DNA that is transferred carries an antibiotic-resistant gene, the intercellular transfer enables the new cell to become antibiotic resistant. Over time, one bacterial cell containing an antibiotic-resistant gene could lead to an army of superbugs. Students will experiment with 2 types of antibiotic resistance bacteria with different antibiotics. After culturing a mixture of these bacteria, they will retest the bacteria with antibiotics to determine if and how the bacteria have shared DNA and become multidrug-resistant.

PLTW 1.2.4 When Antibiotics Fail

In this activity, students will model the effect of the antibiotic on pneumonia using colored disks to represent the bacterial infection. The bacteria causing the infection have varying degrees of antibiotic resistance. Students will simulate what would happen if you did not properly take your antibiotics and determine the role this would play in the development of antibiotic-resistant bacteria. Using colored plastic disks that simulate bacteria with different resistance levels, students will model which ones live and die based on prompts for how and when a patient uses their antibiotics. If not taken properly, bacteria will reproduce, and the population will evolve to be more resistant.

PLTW 1.3.1 Good Vibrations

In this activity, students will investigate the physics of sound, as well as learn how hearing works and what can go wrong in the ear that causes different types of hearing loss. They will be assigned a patient with a specific type of hearing loss and will show the cause of the hearing loss on a model of the ear.

PLTW 1.3.2 Can you hear me now?

In this activity, students will perform a variety of different hearing tests. Then they will explore the various interventions available to help patients cope with hearing loss and make a recommendation as to what intervention is the most appropriate for your hearing loss patient from the previous activity. Students will analyze and interpret audiogram graphs and run hearing tests using tuning forks and gain deeper understanding of audiology and hearing tests.

PLTW 1.3.3 Cochlear Implant Debate

In this activity students will investigate both sides of the cochlear implant debate. Students will use this information to write letters from the perspective of an adult deaf person explaining the reasons a person may or may not want to have this procedure. Students may agree with one side more than another but will be able to empathize with and understand the perspectives of both sides.

PLTW 1.4.1 Vaccinations

Students investigate the history of vaccine development and create models which illustrate the basic mechanisms behind how they work.

PLTW 1.4.2 Vaccine Development

In this activity, students will research the various methods used to produce vaccines. They will then try to genetically engineer and model the formation of a recombinant plasmid used to produce a vaccine for the hepatitis B virus using DNA sequences and plasmids with paper, scissors and glue.

PLTW 1.4.2 Epidemiologists

In this activity, students will research the field of epidemiology and complete four small tasks as they play the role of an epidemiologist at work. They will investigate how to conduct an outbreak investigation, analyze disease data, design an epidemiologic study, and evaluate prevention and therapy for chronic and infectious diseases.

Assessments and Authentic Experiences:

Contact tracing/mapping
Serial Dilutions
BLAST analysis
ELISA test
Antibiotic Efficacy test
Cochlear Implant Debate
Audiogram tests and analyses
Unit Exam

Extensions (Tier I):

- Additional DNA sequences and scenarios can be provided for the BLAST analysis to help students see more applications, such as new species or fossil ID or close evolutionary relationships
- Lab error analysis questions
- Provide leadership roles in group work/labs

Differentiation (Tiers 2 and 3)

- Group work
- Frequent check for understandings questions and challenge questions
- Study skills (Self-assessment quizzes embedded in curriculum, regular quizzes, digital notecards, study resource folder updated by instructor)
- Frequent use of graphic organizers and charts
- Multiple modes of representation:
  - -videos/ animations provided
  - -Hands on models
  - -Visual aids /diagrams
- Choice in process/ product/ ways to express mastery
- Root words and example words and definitions provided

Stage 3 – Learning Plan

Medical Interventions Unit 1 Digital Access (Password Required):
https://pltw.read.inkling.com/a/b/51ea0660f21e4e6badc97ff5ad8d087c/p/afeb5c86b24846c389946a01c45991c9
The MI curriculum linked above includes laboratory procedures, project requirements, presentations, and research articles used in the design of the learning tasks described in the stage 2 section of this unit plan.

Vocabulary

- Mutation
- Target protein
- Genes
- Antibiotic
- Conjugation
- Resistant gene
- Plasmid
- Pilus
- Transformation
- "Naked" DNA
- Transduction
- Bacteriophage
- Pinna
- Auditory canal
- Eustachian tube
- Ossicles (malleus, incus, and stapes)
- Tympanic membrane (eardrum)
- Cochlea
- Sensory hair cells
- Cochlear nerve
- Oval window
- Vestibule
- Vestibular nerve
- Nucleoid
- Plasmid
- Ribosomes
- Cell wall
- Plasma membrane (cell membrane)
- Capsule
- Flagella
- Pili
- Endotoxins
- Audiogram
- Audiology
- Conductive hearing loss
- Vaccine
- Subunit
- Epidemiology
- DNA
- Polymerase Chain Reaction (PCR)
- Primer
- Nucleotides
- TAQ polymerase
- Cycle Sequencing
- Contact mapping or tracing
- Outbreak
- Pathogen
- BLAST analysis
- Bioinformatics
- Medical Interventions
- Genomes
- Antibody
- Antigens
- Concentration
- Diluent
- Solute
- Solvent
- solution
- Serial dilution
- Standard curve
- Enzyme
- Enzyme-linked immunosorbent Assay (ELISA)
- Substrate
- Absorb
- transmit,
- reflect
- streak
- inoculate
- incubate
- colony
- lawn/field
- aseptic technique
- strain
- recombinant DNA
- restriction enzyme
- sticky end

	• blunt end • palindrome
Expert/Field Experience(s) *Potential guest speakers: otolaryngologists, epidemiologists, audiologists, *Potential field trips: Hospitals, Liberty Science Center	
Literacy Connections/Research Latin / Greek root words of science terms included in lessons Word walls “grown” by students Students research and develop arguments regarding the cochlear implant debate. Students read articles/literature on the antibiotic resistance crisis. Students research various career opportunities related to this unit such as epidemiologists, audiologists, otolaryngologists,	

Special Education/ 504:	**English Language Learners:**

-Adhere to all modifications and health concerns stated in each IEP. -Give students a MENU option, allowing students to pick assignments from different levels based on difficulty. -Accommodate Instructional Strategies: reading aloud text, graphic organizers, one-on-one instruction, class website (Google Classroom), handouts, definition list with visuals, extended time -Allow students to demonstrate understanding of a problem by drawing the picture of the answer and then explaining the reasoning orally and/or writing , such as Read-Draw-Write -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 - During i-Ready lessons, click on "Español" to hear specific words in Spanish - Utilize graphic organizers which are concrete, pictorial ways of constructing knowledge and organizing information - Use sentence frames and questioning strategies so that students will explain their thinking/ process of how to solve word problems - Utilize program translations (if available) for L1/ L2 students - Reword questions in simpler language - Make use of the ELL Mathematical Language Routines (click here for additional information) -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 - 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 math competitions - Alternative instruction pathways available - Common Core Approach to Differentiate Instruction: Students with Disabilities (pg. 20)	- Assure students have experiences that are on the Concrete- Pictorial- Abstract spectrum - Modify Instructional Strategies, reading aloud text, graphic organizers, one-on-one instruction, class website (Google Classroom), inclusion of more visuals and manipulatives, Peer Support - Constant 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.

Technology Standards:

All students will be prepared to meet the challenge of a dynamic global society in which they participate, contribute, achieve, and flourish through universal access to people, information, and ideas.

https://www.state.nj.us/education/cccs/2014/tech/

8.1 Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge. A. Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations. B. Creativity and Innovation: Students demonstrate creative thinking, construct knowledge and develop innovative products and process using C. technology.Communication and Collaboration: Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others. D. Digital Citizenship: Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior. E. Research and Information Fluency: Students apply digital tools to gather, evaluate, and use of information. F. Critical thinking, problem solving, and decision making: Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.	Technology Education, Engineering, Design, and Computational Thinking - Programming: All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment. A. The Nature of Technology: Creativity and Innovation- Technology systems impact every aspect of the world in which we live. B. Technology and Society: Knowledge and understanding of human, cultural, and societal values are fundamental when designing technological systems and products in the global society. C. Design: The design process is a systematic approach to solving problems. D. Abilities in a Technological World: The designed world in a product of a design process that provides the means to convert resources into products and systems. E. Computational Thinking: Programming- Computational thinking builds and enhances problem solving, allowing students to move beyond using knowledge to creating knowledge.