STEM Innovation Academy Unit Plan

Subject: NJIT FRSC 201- Introduction to Forensic Science **Unit Title:** Unit 6- Death, Bugs, and Drugs (Forensic Pathology, Forensic Entomology, and Forensic Toxicology) **Grade:** 12th	**Teacher:** Ms. Dy-Anni Austin **Duration:** 36-80 min blocks (6 Weeks)

Unit Summary

To recognize cause and effect of death on the human body, the chronological chains of events, related biological and chemical changes, the connections between humans and other living things, and understand the potential data made available by concurrent events. Forensic science utilizes all levels of scientific inquiry, specifically chemistry, human physiology and biochemistry,to analyze physical evidence with the ultimate goal of recreating the events of the crime for a jury in a court of law.This unit focuses on drugs, toxicology and the chemistry of alcohol, physical evidence collection and analysis using technology that incorporates core principles from chemistry, physics, biochemistry and human physiology.

Stage 1 – Desired Results

Enduring Understanding *Students will understand that…*

- There are several definitions of death, including the cessation of the heartbeat and brain function.
- An autopsy is performed if a death is suspicious or unexplained.
- A forensic entomologist studies the development of insect larvae in a body to estimate the time of death.
- Chemical compounds classified in the Controlled Substances Act are regulated by the United States government.
- Understand the significance of drug analysis and toxicology to forensic investigations and will be able to identify various drugs and describe methods drug analysts and toxicologists use in identifying substances.
- Toxicology has a long historical presence and many applications in assessing possible cause of death.
- Describe techniques that forensic toxicologists use to isolate and identify drugs and poisons.
- How alcohol is absorbed and processing in a living system

Essential Questions

- How is death defined?
- How can an autopsy help to solve a crime?
- Why is time of death important?
- How can environmental factors influence the time estimate?
- What laboratory tests do forensic scientists rely on to identify unknown chemicals?
- How does chromatography work and how can it be modified to accomplish a specific chemical identification?
- What methods are available to determine the level of sobriety in a suspected impaired driver?
- How is toxicity determined?

Student Learning Objectives

What students should be able to do after instruction.	*Evidence Statements*
Distinguish between four manners of death: natural, accidental, suicidal, homicidal	HS-LS1-1 HS-LS1-2
Distinguish between cause, manner, and mechanisms of death	HS-LS1-1 HS-LS1-2
Explain how the development of rigor, algor and livor mortis occur	HS-LS1-1 HS-LS1-2
Employ evidence of rigor, algor and livor mortis to calculate the approximate time of death	HS-LS1-1 HS-LS1-2
Describe the stages of decomposition in a corpse	HS-LS1-1 HS-LS1-2
Employ autopsy report regarding stomach contents to estimate time of death	HS-LS1-1 HS-LS1-2

Explain how time of death estimates may be linked to insect evidence	HS-LS1-1 HS-LS1-2
Provide an example of the succession of different types of insects that are found on a body as it decomposes	HS-LS1-1 HS-LS1-2
Estimate time of death given insect evidence, rigor, algor and livor mortis data	HS-LS1-1 HS-LS1-2
Describe how various environmental factors may influence the estimated time of death	HS-LS1-1 HS-LS1-2
Identify unknown substances by utilizing a series of chemical tests of the chemical and physical properties of substances	HS-PS1-1 HS-PS1-2 HS-PS1-5 HS-PS1-6 HS-LS1-2 HS-LS1-3
Explain what LD50 is and how it is determined for different substances and use it to classify how toxic a substance is	HS-PS1-1 HS-PS1-2 HS-PS1-5 HS-PS1-6 HS-LS1-2 HS-LS1-3
Human metabolism of alcohol and calculation of blood alcohol content	HS-PS1-1 HS-PS1-2 HS-PS1-5 HS-PS1-6 HS-LS1-2 HS-LS1-3

The Student Learning Objectives above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts

Planning and Carrying Out Investigations:
 	
Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. (HS-LS1-3)
 	
Constructing Explanations and Designing Solutions:
 	
Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world
	• LS1: From Molecules to Organisms: Structures and Processes
	• LS3: Heredity: Inheritance and Variation of Traits
	• Multiple technologies based on the understanding of waves and their interactions with matter are part of everyday experiences in the modern world (e.g., medical imaging, communications,sc
		• Patterns
		  ○ Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena.
		• Cause and effect
		  ○ Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.
		• Structure and function
		  ○ Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of

operate today as they did in the past and will continue to do so in the future. (HS-LS1-1) Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-LS1 6),(HS-LS2-3) **Using Mathematics and Computational Thinking** Use mathematical representations of phenomena or design solutions to support claims. (HS-LS2-4) **Engaging in Argument from Evidence** Evaluate the claims, evidence, and reasoning behind currently accepted explanations or solutions to determine the merits of arguments. (HS-LS2-6) Evaluate the evidence behind currently accepted explanations or solutions to determine the merits of arguments. (HS-LS2-8) **Analyzing and Interpreting Data:** Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible. (HS-LS3-3) **Obtaining, Evaluating, and Communicating Information:** Communicate scientific information (e.g., about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). (HS-LS4-1)	anners) and in scientific research. They are essential tools for producing, transmitting, and capturing signals and for storing and interpreting the information contained in them. (HS-PS4-5)	different components, and connections of components to reveal its function and/or solve a problem. **Connections to Nature of Science** • Science is a human endeavor • Technological advances have influenced the progress of science and science has influenced advances in technology. • Science and engineering are influenced by society and society is influenced by science and engineering.
Stage 2 – Assessment Evidence		

What activities truly support this as an honors level class? Use the last three stages of Bloom's Taxonomy to address this section including 4-analyze- drawing connections among ideas, 5- evaluate- justify a stance or decision, 6- create- produce original work.

Performance Task 1**:* AUTOPSY OF A DILL PICKLE ***(approximately 1 or 2- 80 min blocks)

BACKGROUND Notes for teacher: This activity serves as an introduction to dissection. It also reinforces concepts of anatomical directions, planes, and body cavities. Some imagination must be exercised. Prepare the pickles prior to class. Insert toothpicks for arms and legs. Add a stuffed olive (secured with a toothpick) for a head.

Use these suggestions to add injuries to the pickles:

- Grain of rice in the brain – brain tumor.
- Using a red marker, color a toothpick and jab it into the pickle for a stab wound.
- Make a slit using a scalpel and insert a popcorn kernel or BBs for gun shot.
- Crush a part of the pickle to show trauma.
- Inject blue food coloring into the lung area to simulate a drowning victim.
- Insert a red bead for a normal heart.
- Insert a black bead for a diseased heart or heart attack.
- Add a toothpick inside down the back to serve as the vertebral column.

Background required of students: Students should have read about anatomical planes, directions, regions, and body cavities. They should have illustrations at hand from text or coloring book sheets. They should know what pH means and have some experience with a microscope (one microscope could be set up with a tissue sample by the teacher as a demonstration). If their text has a vignette or section on autopsies, it could be assigned.

Materials needed: 1 large dill pickle for each pair of students, toothpicks, dissecting equipment, pH paper and chart, microscope, slides, and coverslips.

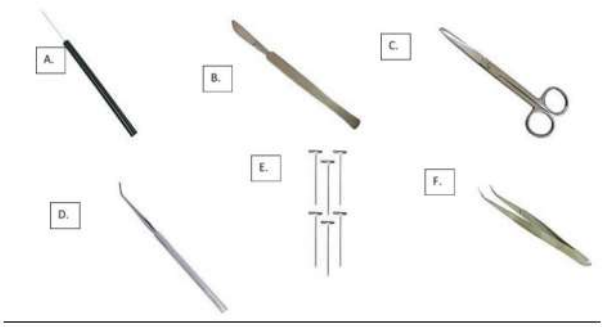
PROCEDURE

1. Build up interest in autopsies for a day or two. Don't tell them what they will autopsy. On the day of the activity, have dissecting trays laid out with tools on them and covered with a white sheet. Place a sheet over the pickle jars, too. Any props or drama you can think of will add to the effect.
2. Pass out student worksheets (below).
3. Caution the students about use of sharp tools and proper behavior in the lab (very important, as this is pretty silly). Display each tool and describe its use in dissection. Students take notes and do matching on hand-out.
4. Hand out the trays and pickles. Partners works well. Instruct the students to make arms and legs and faces on their pickle using toothpicks. Now they may begin the autopsy. Stress the importance of making drawings and labeling them. Mingle among the students and ask questions about orientations, landmarks, incisions. Pickles do not really have cavities, ribcages, sternums, etc., so you may have to help some students with this leap of imagination. To open the "abdominopelvic region" with hinged doors, you need to cut all the way to the base of the pickle and rather deep.
5. Set out pH paper and demonstrate its use, if necessary.

Evaluation: Correct student worksheets for accuracy of labeling, and reasonable use of evidence in reaching conclusions.

Autopsy Pre-Lab – Identify the Dissection Tools Match the tool letter above to its name and function below.

Autopsy Pre-Lab – Identify the Dissection Tools



Match the tool letter above to its name and function below.

Forceps _____	Used for slicing and cutting large specimens_____
Scissors _____	Will grasp delicate tissues _____
Blunt Probe _____	To cut skin and fascia or to spread tissue layers _____
Dissecting needle _____	Used to manipulate or to poke at objects/openings _____
Scalpel _____	Used to hold back layers for better viewing or to keep on the tray _____
Dissecting Pins _____	To inspect small organs or tease apart tissues _____

Autopsy of a Dill Pickle Performed by Dr. _____ and Dr._____ Coroner, from Irwin County. Date of autopsy _____ Time _____ Date _____

Pickle Name _____

Cause of Death _____

Tools: scalpel, forceps, dissecting pan, scissors, dissecting needles (or toothpicks), dropper, pH paper, slides and coverslips, microscopes, digital camera/phone, gloves.

Body Exterior: Describe the exterior of the body to find any wounds, scars, tattoos, etc. Make a sketch and add labels of both the dorsal and ventral views of your victim. Label all markings on your drawing. Note any abnormalities, objects, etc. and their locations. (using appropriate terms for locations) Ex: a deep cut is located in the anterior end proximal to the face.

Dorsal description: Ventral description:

Body Interior:

1. Turn your specimen so that its ventral side is up. You will make an incision (cut) and you will draw and label your pickle according to these instructions: The ventral body cavity (A) is opened by a deep "Y-shaped" incision. The arms of the Y start at the anterior surface of shoulders (B) and join at the inferior point of the sternum (breastbone) (C) to form a single cut that extends to the pubic area (D).

a. What type of cut are you making when you cut the "Y" incision? (sagittal?, transverse?, frontal?, oblique?) Explain.
b. Draw the pickle and the lines of incision. Label A – D.

2. After the ribcage is sawn through, the abdominopelvic region (E) can be opened like a hinged door (F) to expose the internal organs (G). The contents of the thoracic cavity (H) will also be visible. The second stage of the autopsy includes careful examination of the internal organs. The brain is to be examined, a portion of the skull must be removed by using a transverse cut at the very top of the head. (The face, arms and legs are usually not dissected unless there is a specific reason for doing so.)
    a. Draw the pickle at this stage of the autopsy. Label E – H. Indicate the superficial and deep layers.
    b. Also make an enlarged drawing of at least 2 organs.
    c. Remove the skull cap and remove the brain. Check the brain and look for any abnormalities. Record findings here:
3. Toxicology: Collect a sample of body fluid using the dropper and test the pH of the body fluid using the pH paper. pH= _____ Is this body fluid acidic, basic or neutral? _____ (Normal pH of human body tissues is 7.35-7.45) (pH of pickle juice is around 4)
4. Prepare your patient for burial by replacing the organs and closing the flaps. Wrap your patient in paper towels and have a brief memorial service for him or her. Dispose of the remains in the trash receptacle.
5. Thoroughly rinse your dissecting tools and pan. Dry them completely with paper towels and return these to your teacher. Throw the pH paper in the trash can.

Conclusions/final autopsy report: What is your finding about the cause of death of this patient? Support your opinion with specific details from the autopsy. Use appropriate terminology from this unit and apply within your answer. Write a story that goes with the evidence. Include the detailed descriptions of the body to support your claim. Adapted by Katherine M. Noonan from Dough Bunch's "Dissect a Pickle." Adapted from Heather Peterson, MTSA Journal, Spring 2006, www.msta.mich.org

DIFFERENTIATION: To accurately measure three-dimensional learning of the NGSS along with the CCSS for mathematics, modifications and/ or accommodations should be provided during instruction and assessment.

TECHNOLOGY: Chromebooks and internet.

Performance Task 2: **Forensic Toxicology** ***(approximately 2- 80 min blocks)***

Breath Testing. Students should become familiar with the operation of a breath-testing device. One interesting demonstration involving a breath tester requires an instructor to rinse his or her mouth with some 80–90 proof liquor without swallowing the beverage. The subject is then tested on the breath tester 10, 15, and 20 minutes from the time the liquor is removed from the mouth. The breath-test reading of the subject will be zero after 20 minutes. Traces of alcohol in the mouth will produce excessively high readings. It takes 20 minutes for mouth alcohol to dissipate. For this reason, a properly conducted breath test requires that a subject be observed for 20 minutes prior to the administration of a breath test in order to verify that no oral intake of alcohol has occurred during this period of time.

Blood-Alcohol Level. A person's blood-alcohol concentration (BAC) depends on several factors, including number of drinks, total elapsed time drinking, body mass, and gender. This demonstration illustrates the fact that one must take into account all of these factors when determining when one is legally intoxicated. At the beginning of class, give each student a piece of paper that reads: "Imagine you have been drinking for two hours and in that time you have consumed five beers. Do you believe you are legally intoxicated?" Have each student write his or her name and answer on the

paper and turn it in immediately. Before the next class, have students enter this information, along with data about weight and gender, into an online BAC calculator to determine whether they were correct. At the beginning of the following class, return the sheets to the students and ask how many guessed incorrectly. This can lead to a discussion of the effects of alcohol and factors that influence drug reactions.

pH Test

Materials

pH paper with color indicator chart

Liquid samples of acid and base substances (examples: tap water, bottled water, soda, ice tea, baking soda in water, salt water, lime juice, cleaning solution, liquid soap)

Procedure

pH can help toxicologists determine what type of toxin may be present in a sample. This activity will allow you to identify the pH of some common substances. Before you begin, write a guess of what you think the pH of each sample will be. Now, take a piece of pH paper and dip into the first sample for a few seconds. Compare the pH paper to the color indicator chart and determine what the pH is of the sample. Record your observations. Repeat this for each sample.

Follow-Up Questions

1. How many samples did you guess correctly before testing them? Which ones were they?
2. Create a pH chart with labels for Acid, Base, and Neutral. Also label where each item you tested would be on your chart.
3. A toxicologist would test samples of what to determine the pH of the toxin in a body?

DIFFERENTIATION: To accurately measure three-dimensional learning of the NGSS along with the CCSS for mathematics, modifications and/ or accommodations should be provided during instruction and assessment.

TECHNOLOGY: Chromebooks and internet.

Other Evidence:

Before	During	After
KWL – Students will list what they know and what they want to know about the main topics of this unit. **Brainstorming** – Students will discuss what they know about Scientific Inquiry by breaking down the word and coming up with various meanings. **Quick Writes** – Before each lesson students will be asked to write their	**Journals** – Students will complete daily journal reflections and take notes when necessary. **Lab Investigations** – Students will complete one or more lab investigation(s) exploring and utilizing chemistry principles. **Daily Assignments** – Students will be given vocabulary assignments and calculation problems.	**Unit Test** – Students will be given a test after the unit has been completed and Presentations have been given **PowerPoint Project** – Students will create a PowerPoint Presentation (as a group) of this unit. This will include various concepts, experimental data, vocabulary, and applications in the “real world”.

thoughts and questions for the day pertaining to the objectives. **Pretest** – Students will be given an assessment to understand their knowledge on the unit before any instruction is given.	**Observations** – Students will write down any observations in their journals as witnessed in class or during their labs. **Think-Pair-Share** – Students will work in pairs to discuss vocabulary and reinforce rules as they are introduced. **Quizzes –** Give short quizzes or Exit Cards - to show mastery of concepts needed before moving to the next concept.	

Student Self-Assessment and Reflection:

Students will write down their questions and or comments of the day's events. They will write their questions about any topics or problems they may have, and they will discuss them as a class the following day. Students will also write down any observations they experienced during labs and/or lecture presentations into their Journals.

Stage 3 – Learning Plan

Differentiated Instruction (by student readiness):

Tiers 2-3: Students who have scored a 3 or below (approaching expectations) on the ELA and Math NJSLAs

1. Scaffolding
2. Group work
3. Peer tutoring
4. One on one discussions
5. Office hour appointments
6. Laboratory Investigations
7. Group PowerPoint Presentation
8. Unit Test

Tier 1: Students who have scored a 4 or 5 (met or exceeded expectations) on the ELA and Math NJSLAs

1. One on one discussions
2. Office hour appointments
3. Laboratory Investigations
4. Group PowerPoint Presentation
5. Unit Test

Learning Activities

1. Time of Death Calculations
2. Nova Documentary: The Body Farm
3. Entomology Evidence/Create your own body farm
4. Digital Autopsy/Fetal Pig Autopsy
5. Forensic Toxicology Virtual Lab
6. The Science Spot http://sciencespot.net/Pages/classforsci.html
7. What happens when a body dies http://www.madsci.org/posts/archives/2005-04/1114460899.Gb.r.html
8. Autopsy http://www.pathguy.com/autopsy.htm
9. National Geographic Body Farm http://video.nationalgeographic.com/video/body-farm-sci
10. Forensic Entomology http://www.forensic-entomology.com/
11. CSI Web Adventures http://forensics.rice.edu/index.html
12. NIH –alcohol metabolism - http://pubs.niaaa.nih.gov/publications/AA72/AA72.htm
13. Elmhurst College Alcohol Information - http://www.elmhurst.edu/~chm/vchembook/642alcoholmet.html
14. DEA Schedule of Controlled Substances - http://www.deadiversion.usdoj.gov/schedules/304; http://www.justice.gov/dea/druginfo/ds.shtml
15. Department of Justice Toxicology - http://www.nij.gov/topics/forensics/evidence/toxicology/Pages/welcome.aspx

Vocabulary:

algor mortis, autopsy, cause of death, forensic anthropology, forensic entomology, forensic pathologist, livor mortis, manner of death, petechiae, post mortem interval, rigor mortis, absorption, acid, alveoli, anticoagulant, artery, base, capillary, excretion, fuel cell detector, metabolism, oxidation, pH scale, preservative, toxicologist, vein

Literacy and Math Connections:

English Language Arts/Literacy –
RST.11-12.2. Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.
RST.11-12.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
RST.11-12.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 11–12 texts and topics*.
RST.11-12.8. Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.
RST.11-12.9. Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible

Mathematics –

4.5 B. Communication

1. Use communication to organize and clarify their mathematical thinking

2. Communicate their mathematical thinking coherently and clearly to peers, teachers, and others, both orally and in writing.

3. Analyze and evaluate the mathematical thinking and strategies of others.

4.5 C Connections

3. Recognize that mathematics is used in a variety of contexts outside of mathematics.

4. Apply mathematics in practical situations and in other disciplines.

4.5 D Reasoning

4. Rely on reasoning, rather than answer keys, teachers, or peers, to check the correctness of their problem solutions.

5. Make and investigate mathematical conjectures

4.5 E Representations

1. Create and use representations to organize, record, and communicate mathematical ideas as pictorial or symbolic.

Expert/Field Experiences:

NJIT Forensic Science Mock Apartment
David Fisher
University Heights, NJ 07102

Connection to End of Year Project:

Students will participate in a Murder in Miniature Project based on Fransis Glessner Lee's Nutshells.
For this final project, in a team of up to two students, you will design and create a diorama of a crime scene (murder). You will give your diorama a title and brief description along with a detailed crime scene sketch and autopsy report of the victim. You will then give a presentation (from the perspective of a prosecutor) linking all of the evidence to a particular suspect. This three part project will be your 'final exam' grade in this college course. It will count as ONE

test grade and TWO authentic assessment grades for the 4th marking period at STEM. This project has three parts: Diorama, Written Portion, and Prosecution Presentation. Murder in Miniature Worksheet with Rubric. This unit provides opportunities for self-organization, group cooperation, and idea sharing, as well as proper research techniques, repeat trails, error analysis, and communication of results through a presentation or model.

Modifications

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:

udents 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 technology.
C. **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

8.2 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.

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.	E. **Computational Thinking: Programming-** Computational thinking builds and enhances problem solving, allowing students to move beyond using knowledge to creating knowledge.