STEM Innovation Academy Unit Plan

Subject: NJIT FRSC 201- Introduction to Forensic Science Unit Title: Unit 7- Forensic Anthropology (Bones and Teeth) Grade: 12th **Teacher:** Ms. Dy-Anni Austin **Duration:** 6-80 min blocks (2 Weeks)

Unit Summary

To understand the composition, development and structure of bones to recognize the wealth of postmortem information made available.

Stage 1 – Desired Results				
 Enduring Understanding Students will understand that Forensic anthropologists identify and examine human skeletal remains to gain insight into a crime. Bones reveal key information about the age, race, sex, health, and lifestyle of the person How can the knowledge of human anat specifically the skeletal system, help for scientists? How can bones be used to build a description of the person? 				
Student Learning Objectives				
What students should be able to do after instruction. Evidence Statements				
Describe how bone is formed HS-LS1-6 HS-LS1-7				
Distinguish between male and female skeletal remains based of brow ridge, pelvis and femur	n skull, jaw, HS-LS1-6 HS-LS1-7			
Describe how bones contain a record of disease and injury	HS-LS1-6 HS-LS1-7			
Describe how age determination may be based upon an analysis of bone HS-LS1-6 HS-LS1-7				
Explain human facial structure differences based upon race HS-LS1-6 HS-LS1-7				
Describe the role of mitochondrial DNA in bone identification HS-LS1-6 HS-L S1-7				
The Student Learning Objectives above were developed us	ing 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)	 LS1: From Molecules to Organisms: Structures and Processes LS3: Heredity: Inheritance and Variation of Traits 	 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

Constructing Explanations and Designing	
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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 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	claims about specific
neer review) and the assumption that theories	causes and effects.
and laws that describe the natural world	• Structure and function
operate today as they did in the past and will	 Investigating or designing
continue to do so in the future. (HS-LS1	new systems or structures
6),(HS-LS2-3)	examination of the
	properties of different
Using Mathematics and Computational	materials, the structures of
Thinking	different components, and
Use mathematical representations of	connections of components
claims (HS-I S2-4)	to reveal its function and/or
Ciamis. (115-152-4)	solve a problem.
Engaging in Argument from Evidence	Connections to Nature of Science
Evaluate the claims, evidence, and reasoning	 Science is a human endeavor
behind currently accepted explanations or	 Technological advances have
solutions to determine the merits of	influenced the progress of science
arguments. (HS-LS2-6)	and science has influenced
Evaluate the evidence behind currently	advances in technology.
accepted explanations or solutions to	Science and engineering are
determine the merits of arguments. (HS-LS2-	influenced by society and society is
8)	influenced by science and
	engineering.
Analyzing and Interpreting Data:	
Apply concepts of statistics and probability	
(including determining function fits to data,	
slope, intercept, and correlation coefficient	
uestions 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)				
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-<u>analyze</u>- drawing connections among ideas, 5- <u>evaluate</u>- justify a stance or decision, 6- <u>create</u>- produce original work.

Performance Task 1: Drawing Conclusions from Physical Evidence: Forensic Anthropology. *(approximately 2-80 min blocks)*

Close observation of physical evidence helps forensic experts answer important questions during the investigation of a crime. Forensic anthropologists, who specialize in analyzing evidence of human remains, are sometimes asked to determine the sex of a victim from nothing more than scattered bones. This is typically accomplished by measuring the dimensions of certain bones such as the pelvis, which shows significant differences between the sexes. In this demonstration students are asked to use their observation and reasoning skills to determine the difference between male and female skeletons, then to use that knowledge to determine the sex of three unknown pelvises.

Provide the following information about two typical skeletons—one male and one female. The students will use this information to form conclusions about differences between the skeletons of each sex. (The sacrum is a bone that joins the two halves of the pelvic girdle at the top. Femur spread A is the distance between the upper leg bones about 2 inches below the hip joint. Femur spread B is the distance between the upper leg bones at a point about 2 inches below femur spread A.)

	Pelvic Width	Pelvic Opening	Sacrum Length	Sacrum Width	Femur Spread A	Femur Spread B
Male Pelvis	16"	7"	6"		16"	16"
Female Pelvis	17"	9"	4"		14"	13"

Following are the measurements of the unknown pelvises:

	Pelvic	Pelvic	Sacrum	Sacrum	Femur	Femur
	Width	Opening	Length	Width	Spread A	Spread B
Pelvis A	18"		6"	8"	17"	

Pelvis B 7" 17"

Pelvis C

15"

The students should draw the following conclusions from studying the "sample" pelvises:

The pelvic opening in the female is much wider in relation to its width than is the male pelvic opening.

7"

- The female sacrum is very wide in relation to its length; the length and width of the male sacrum are roughly • equal.
- The upper leg bones of the female bow inward from point A to B on the femur; the male leg bones do not bow ٠ inward.

Based on these observations, the student should conclude that pelvises A and C are female, while pelvis B is male.

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. Padlet.

During	After
Journals – Students will complete daily journal reflections and take notes when necessary. Lab Investigations – Students will	Unit Test – Students will be given a test after the unit has been completed and Presentations have been given
complete one or more lab investigation(s) exploring and utilizing chemistry principles.	PowerPoint Project – Students will create a PowerPoint Presentation (as a group) of this unit. This will
Daily Assignments – Students will be given vocabulary assignments and calculation problems.	experimental data, vocabulary, and applications in the "real world".
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.	
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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. The Science Spot http://sciencespot.net/Pages/classforsci.html
- 2. Facial Reconstruction http://anthropology.si.edu/writteninbone/facial_reconstruction.html
- 3. Forensic Anthropology <u>http://www.sfu.museum/forensics/eng/pg_media-media_pg/anthropologie-anthropology/</u>
- 4. Investigative Techniques http://www.pbs.org/opb/historydetectives/technique/learning-from-skeletons/
- 5. John Wayne Gacy Case Study <u>http://aboutforensics.co.uk/john-wayne-gacy/</u>

Vocabulary:

Osteology, Odontology, Excavation Suture, Exhume, Entomology, Diaphysis, Reconstruction, Adipocere, Metamorphosis, Epiphysis, Clandestine, Decomposition, Anthropometry, Ossification, Putrefaction, Anthropology, Forensic Anthropology, Joints, Mitochondrial DNA, Osteobiography, Osteoblast, Osteoclast, Osteoporosis, Skeletal trauma analysis, Anterior, Posterior, Superior, Inferior, Lateral, Medial, Proximal, Distal

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. <u>Murder in Miniature Worksheet with Rubric</u>. 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	 Use manipulatives to promote conceptual
in each IEP. -Give students a MENU option, allowing students to	understanding and enhance vocabulary usage Provide graphic representations, gestures, drawings,
pick assignments from different levels based on	equations, realia, and pictures during all segments of
difficulty. -Accommodate Instructional Strategies: reading aloud	instruction During i-Ready lessons, click on "Español" to hear
text, graphic organizers, one-on-one instruction, class	specific words in Spanish Utilize graphic organizers which are concrete,
website (Google Classroom), handouts, definition list	pictorial ways of constructing knowledge and
with visuals, extended time -Allow students to demonstrate understanding of a	organizing information

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 <u>(click here)</u> - Make use of strategies imbedded within lessons -Common Core Approach to Differentiate Instruction: Students with Disabilities <u>(pg 17-18)</u>	 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 wellbeing. CRP4. Communicate clearly and effectively and with reason. CRP5. Consider the environmental, social and economic impacts of decisions. 	 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
 CRP6. Demonstrate creativity and innovation. 	• CRF12 . Work productivery 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 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.

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