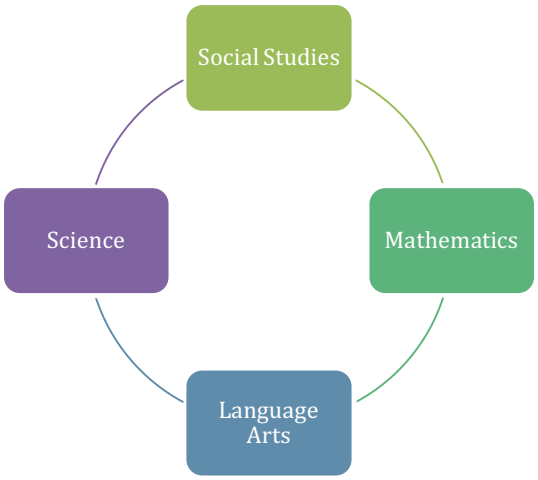
STEM School Chattanooga
10th Grade PBL
Unit Plan

Unit 3: Unum- Python Coding



Learning Target Topics

Algebra II: Sequences, Systems of Equations, Quadratic Functions, Transformations of Functions

Geometry: Coordinate Geometry, Triangle Theorems, Trigonometry

English II: Demonstrate command of the conventions of standard English grammar and usage

Chemistry: Demonstrate a clear grasp of Chemistry Unit 1 Learning Targets

U.S. History: Determine central ideas from source documents and evaluate various explanations for historical events

Grade Level	10th Grade	Unit Length	6 Weeks
Unit Overview	In the first half of the unit, students will use codecademy.com to learn the Python coding language without assistance from teachers. Students will be able to work independently or collaboratively to complete the work, and short quizzes created by Unum staff and four student Python experts will be administrated to determine individual Python coding proficiency. In the second half of the unit, students will work in groups of three using Python to write programs. Programs will be written to help solve math and science problems, as well as a "choose your own adventure" game for historical events. The unit will conclude with groups participating in a coding challenges competition at the school created by Unum staff and student Python experts. The top groups in the school-based competition will then be invited to compete in a similar coding challenge against Unum employees at Unum's headquarters for viewing by all Unum employees.		
Unit Essential Issue	**Problem**: How do you use Python to code useful programs or games for core classes?		
Culminating Events (Kick Off, Midterm Events, and Groups)	**Kick Off – January 21** Students will travel to Unum's Atlanta data center to learn about practical applications of the Python coding language. Students will receive two grades for this PBL: one individual, one group. **Individual Portion** Students will complete 9 units from Codecademy's lessons on Python. They will take two quizzes and a final applied coding assessment (created by Unum staff and student Python experts) to determine individual		

proficiency level. The Python coding PBL individual grade will be assessed as follows:

- BA (basic): Completing the first 6 Python units in codecademy.com and pass Quiz 1
- PR (proficient): Complete the first 6 Python units in codecademy.com and pass Quiz 1 and 2
- AD (advanced): Complete all 9 Python units in codecademy.com and pass Quiz 1 and 2

Dates for Individual Assessments

- 1/21/15 Python Quiz 1 – Units 1-6
- 1/28/15 Python Quiz 2 – Units 1-9

Group Portion

In groups of three, students will work together to write code for each of the core content classes. The attached rubric will be used to assess group PBL performance and grade. The final group PBL grade will be assigned as follows:

- BB: One or more of the content areas do not meet Proficient requirements
- PR: All content areas are at least at Proficient requirements or better
- AD: All content areas are at Advanced requirements

Turn-in day – February 19

Teams will submit completed code work for core content areas.

Competition – Thursday March 10

Teams will compete against each other at STEM School, completing coding challenges based on what they learned in Codecademy.

Unum Competition – Wednesday March 16

The top teams from the STEM coding competition will then compete at Unum in their showcase competition.

Common Assessment

STEM School Chattanooga

STEM PBL Rubric

PBL Unit: #2 Unum
Student: _____
Date: _____

	Advanced	Proficient	Needs Improvement
Math Components: **Algebra II**	✓ Take any one (1) of your completed tasks from the Proficient column and perform the corresponding enhancements: A. To program A, add an option where you can apply a transformation to the given quadratic and receive the new equation, new x-intercepts, and a short description of how the function changed (e.g., "up 2"). Include options for *f(x+k)*, *f(x) + k*, *k*f(x)*, and *f(kx)*. B. To program B, add an option that will allow you to choose between 2 different equation types before inputting each equation in the system. There should be at least 3 types represented. C. To program C, add an option where you can input five numbers and it will tell you whether they belong to an arithmetic sequence, a geometric sequence, or neither. If the numbers used can be represented as a sequence, the program should	✓ Choose and complete at least two (2) of the following tasks: A. Create a program that will give you the x-intercepts of a quadratic polynomial function given a, b, and c. B. Create a program that will solve a specific type of system of equations given the two equations (i.e., two exponentials, one quadratic and one rational, etc.). One, but not both of your equations may be linear. C. Create a program that will give you the first five terms of arithmetic and geometric sequences given the starting value and the common difference/ratio.	

		print the recursive or explicit formula as well.		
	Math Components: **Geometry**	✓ Take any one (1) of your completed tasks from the Proficient column and perform the corresponding enhancements: A. To program A, add an option where you can input the distance and the coordinates of one endpoint and get two possible options for the second endpoint. Only one of these options may be horizontally or vertically aligned with the first endpoint. B. To program B, add an option that will draw the midsegment triangle inside the original equilateral triangle and give you the length of each side. C. To program C, add an option where you can solve for an unknown angle measure in a right triangle given two side lengths.	✓ Choose and complete at least two (2) of the following tasks: A. Create a program that will give you the distance between any two points given their ordered pairs. B. Create a program that will draw an equilateral triangle given a side length. C. Create a program that will solve for the unknown side of a right triangle given a side and an angle.	
	Science Components: **Chemistry**	✓ Code a quiz for each of the following Chemistry Learning Targets from the Proficient section. ○ If answered correctly, the next question is displayed. ○ If answered incorrectly, an explanation with additional examples is displayed, then return to the previous question. ✓ Must have at least one question for each topic listed in the vocabulary section for a total of at least ten (10) questions.	✓ Write Python code to review the following Chemistry Learning Targets: ○ *Compare and contrast the major models of the atom (i.e., Bohr, Rutherford, and the quantum mechanical model)* ○ *Describe the trends found in the periodic table with respect to atomic size, ionization energy, and electronegativity* ○ *Distinguish among elements, compounds, and mixtures* ✓ Demonstrate a clear understanding of the chosen Chemistry Learning Targets	
	Language Arts Components: **English II**	✓ Code a quiz for each of the grammar areas. ○ If answered correctly, the next question is displayed. ○ If answered incorrectly, an explanation with additional examples is displayed, then returns to the previous question. ✓ Must have two questions for each grammar area for a total of six (6) questions.	✓ Write Python code to review the following grammar topics:: ○ Identifying the difference between a fragment and a complete sentence. ○ Understanding comma splices, semi-colons, and colons. ○ Understanding subject and verb agreement with intervening phrases. ✓ Demonstrate understanding of chosen grammar topics	
	Social Studies Components: **U.S. History**	✓ Story will contain detailed events and settings that put the player/reader into the action. ✓ Outcomes will have historically accurate events and happenings that come from a multitude of sources. ✓ Setting and description of events and choices are historically accurate and engulfs the reader/player into the story. ✓ Story creates a believable/historically accurate depiction of a WWII situation at each level.	✓ Write and recreate a storyboard in Python Code from the group to create a "Choose Your Own Adventure" ✓ The story must be based on Historically accurate events of a fictional character from the WWII era. ✓ Story must contain five, multi decision levels with varied outcomes. ✓ Outcomes must be based on historical events and happenings. ✓ Students must have sources and citation for each decision.	

	Minimum Requirement Components: **Must be included to be graded**	General: ✓ All coding must be done using the Python language. ✓ Finished code must be fully functional to create a fluid start and ending with no syntax errors or crashes. ✓ Must complete the first 6 assigned Python lessons from Codecademy. 1. Python Syntax 2. Strings and Console Output 3. Conditionals and Control Flow 4. Functions 5. Lists & Dictionaries 6. Student Becomes the Teacher Math: ✓ At least one finished piece of code for each Algebra II and Geometry (see above for what "finished" means). English II: ✓ Mini-lesson explaining each grammar topic. o At least three different examples for each US History: ✓ Citation must be present at each decision. ✓ Each ending must contain a 1-page write up explaining the historical accuracy of the decision the characters made.
Unit Learning Targets	*Algebra 2:* • I can solve quadratics using *a+bi* for imaginary solutions. • I can identify the effect of applying a specific transformation to a given function. • I can solve non-linear systems of equations. • I can recognize and write sequences as functions. • I can write explicit and recursive sequences and use them to solve problems. *Geometry:* • I can use coordinates to prove theorems algebraically. • I can prove triangle congruence theorems. • I can use trigonometry and the Pythagorean Theorem to solve right triangles in a context. *Chemistry:* • I can describe the trends found in the periodic table with respect to atomic size, ionization energy, and electronegativity • I can distinguish among elements, compounds, and mixtures • Compare and contrast the major models of the atom (i.e., Bohr, Rutherford, and the quantum mechanical model) *English:* • I can use various types of phrases and clauses to convey meaning and add variety and interest to my writing. • I can use a semicolon to link two or more related independent clauses. • I can use a colon to introduce a list or quotation. *History:* • I can determine the central ideas or information of a primary or secondary source; provide an accurate summary that makes clear the relationships among the key details and ideas. • I can evaluate various explanations for actions or events and determine which explanation best accords with textual evidence, acknowledging where the text leaves matters uncertain.	
Vocabulary	Math: Algebra II	1. Root 2. Solution to a system of equations 3. Arithmetic sequence 4. Geometric sequence

	5. Common difference 6. Common ratio 7. Explicit 8. Recursive
Math: Geometry	1. Distance 2. Midsegment 3. Midsegment triangle 4. Trigonometry 5. Sine 6. Cosine 7. Tangent
Science: Chemistry	1. Bohr Model 2. Rutherford Model 3. Quantum Mechanical Model 4. Atomic Size 5. Ionization Energy 6. Electronegativity 7. Elements 8. Compounds 9. Homogeneous Mixture 10. Heterogeneous Mixture
Language Arts: English II	1. Independent Clause 2. Intervening Phrase 3. Mini-lesson
Social Studies: U.S. History	1. Evaluation 2. Reasoning 3. Textual Information