Unit 2 - Why Program? - Computational Thinking

Content Area: **Sample Content Area**
Course(s): **Sample Course**
Time Period:
Length: **High School- Year Course**
Status: **Published**

Why Program? - Computational Thinking -Python

Department of Curriculum and Instruction

Belleville Public Schools

Curriculum Guide

Introduction to Python

Unit 1- Why Program?

Belleville Board of Education

102 Passaic Avenue

Belleville, NJ 07109

Prepared by: Teacher, Corey Woodring

Dr. Richard Tomko, Ph.D., M.J., Superintendent of Schools

Ms. LucyAnn Demikoff, Director of Curriculum and Instruction K-12

Ms. Nicole Shanklin, Director of Elementary Education

Mr. Joseph Lepo, Director of Secondary Education

Board Approved:

Unit Overview

Unit Overview -

Writing programs (or programming) is a very creative and rewarding activity. You can write programs for many reasons, ranging from making your living to solving a difficult data analysis problem to having fun to helping someone else solve a problem. This course assumes that *everyone* needs to know how to program, and that once you know how to program you will figure out what you want to do with your newfound skills.

We are surrounded in our daily lives with computers ranging from laptops to cell phones. We can think of these computers as our "personal assistants" who can take care of many things on our behalf. The hardware in our current-day computers is essentially built to continuously ask us the question, "What would you like me to do next?

- Why should you learn to write programs?
- Creativity and motivation
- Understanding programming
- Words and sentences in Python

Enduring Understanding

- Creativity and computing are prominent forces in innovation.
- Abstraction is a central problem-solving technique.
- Algorithms are precise sequences of instructions for processes that can be executed by a computer and are implemented using programming languages.
- Cybersecurity is an important concern for the Internet and the systems built on it.
- What is programming? Introduction to Python programming ● Learning commands to move Tracy the turtle in the canvas

Essential Questions

Essential Questions:

● What are computers and what is programming?

● How is programming an essential part of the digital age?

● What is Python programming? ● How do you write Python to move Tracy the turtle?

Exit Skills

Skills Gained

Working within in an engaging, hands-on learning environment, guided by the instructor, students will learn to:

- Create working Python scripts following best practices
- Use python data types appropriately
- Read and write files with both text and binary data
- Search and replace text with regular expressions
- Get familiar with the standard library and its work-saving modules

- Create "real-world", basic level professional Python applications
- Know when to use collections such as lists, dictionaries, and sets
- Understand Pythonic features such as comprehensions and iterators
- Write robust code using exception handling

New Jersey Student Learning Standards (NJSLS-S)

CS.9-12.8.1.12.AP.1	Design algorithms to solve computational problems using a combination of original and existing algorithms.
CS.9-12.8.1.12.CS.2	Model interactions between application software, system software, and hardware.
CS.9-12.8.1.12.CS.3	Compare the functions of application software, system software, and hardware.
CS.9-12.AP	Algorithms & Programming
CS.9-12.CS	Computing Systems
TECH.8.1.12	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.
TECH.8.1.12.A	Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations.
TECH.8.1.12.A.CS1	Understand and use technology systems.
TECH.8.2.12.E.1	Demonstrate an understanding of the problem-solving capacity of computers in our world.
TECH.8.2.12.E.2	Analyze the relationships between internal and external computer components.
TECH.8.2.12.E.3	Use a programming language to solve problems or accomplish a task (e.g., robotic functions, website designs, applications, and games).
TECH.8.2.12.E.4	Use appropriate terms in conversation (e.g., troubleshooting, peripherals, diagnostic software, GUI, abstraction, variables, data types and conditional statements).
TECH.8.2.12.E.CS1	Computational thinking and computer programming as tools used in design and engineering.

A computing system involves interaction among the user, hardware, application software, and system software.

Individuals select digital tools and design automated processes to collect, transform, generalize, simplify, and present large data sets in different ways to influence how other people interpret and understand the underlying information.

Interdisciplinary Connections

Interdisciplinary Connection Math: F-IF/F-BF: Functions Example: Students will be writing functions in the program which has the similar connection to the Functions in Math. Parameters are the values of x and return value from the function is value of y

Interdisciplinary Connection ELA: NJSLSA.W8: Gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism Example: When students are asked to do a research project, the online content that they use should be checked for copyrights. Just like this, when students are asked to write a program to solve a problem, they should think about using their knowledge of content in solving, but not copying code from an online resource. High School Geometry – Students will be asked to work on a 400X400 canvas. This canvas will act as a coordinate plane and students will be working on drawing shapes and images according to the given description and placement.

21st Century Life and Careers

9.1.12.B.1, 9.1.12.F.2

9.3.12.K3.2, 9.3.12.K3.4, 9.3.12.K3.5, 9.3.12.K3.6

21st century life and careers

Technology

Digital Literacy

English Language Arts

Reading

Writing

Speaking and Listening (communication skills)

Mathematics

Social science

Science and the Engineering Practices

Career Ready Practices

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.

CRP11. Use technology to enhance productivity.

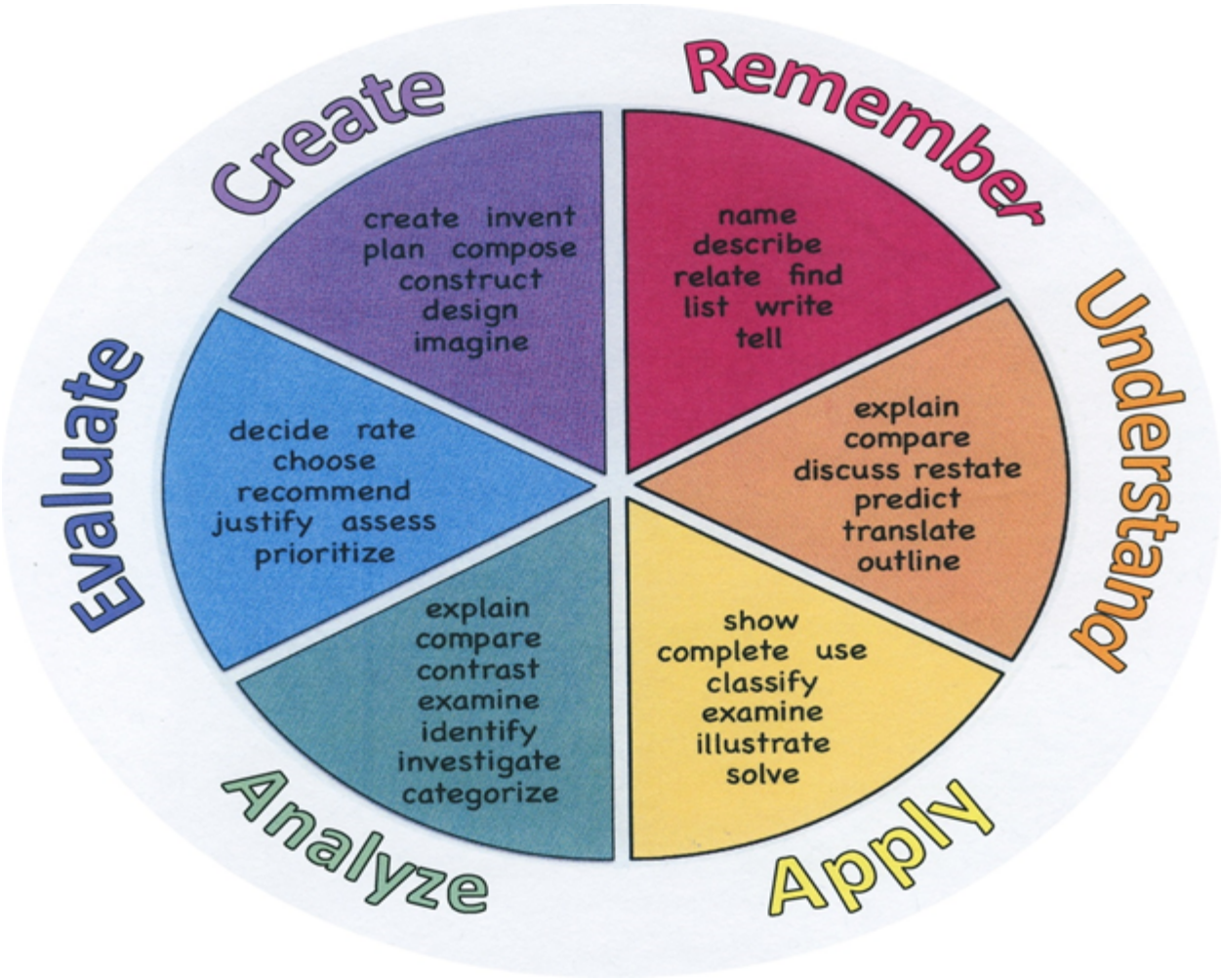
Learning Objectives

The learning objectives of this unit are:

- To understand why Python is a useful scripting language for developers.
- To learn how to design and program Python applications.
- To learn how to use lists, tuples, and dictionaries in Python programs.
- To learn how to identify Python object types.
- To learn how to use indexing and slicing to access data in Python programs.
- To define the structure and components of a Python program.
- **Learning** Outcomes: Problem solving and programming capability.

Action Verbs: Below are examples of action verbs associated with each level of the Revised Bloom's Taxonomy.

Remember	Understand	Apply	Analyze	Evaluate	Create
Choose	Classify	Choose	Categorize	Appraise	Combine
Describe	Defend	Dramatize	Classify	Judge	Compose
Define	Demonstrate	Explain	Compare	Criticize	Construct
Label	Distinguish	Generalize	Differentiate	Defend	Design
List	Explain	Judge	Distinguish	Compare	Develop
Locate	Express	Organize	Identify	Assess	Formulate
Match	Extend	Paint	Infer	Conclude	Hypothesize
Memorize	Give Examples	Prepare	Point out	Contrast	Invent
Name	Illustrate	Produce	Select	Critique	Make
Omit	Indicate	Select	Subdivide	Determine	Originate
Recite	Interrelate	Show	Survey	Grade	Organize
Select	Interpret	Sketch	Arrange	Justify	Plan
State	Infer	Solve	Breakdown	Measure	Produce
Count	Match	Use	Combine	Rank	Role Play
Draw	Paraphrase	Add	Detect	Rate	Drive
Outline	Represent	Calculate	Diagram	Support	Devise
Point	Restate	Change	Discriminate	Test	Generate
Quote	Rewrite	Classify	Illustrate		Integrate
Recall	Select	Complete	Outline		Prescribe
Recognize	Show	Compute	Point out		Propose
Repeat	Summarize	Discover	Separate		Reconstruct
Reproduce	Tell	Divide			Revise
	Translate	Examine			Rewrite
	Associate	Graph			Transform
	Compute	Interpolate			
	Convert	Manipulate			
	Discuss	Modify			
	Estimate	Operate			
	Extrapolate	Subtract			
	Generalize				
	Predict				



Suggested Activities & Best Practices

Coding Skills:

- Explain how algorithms are implemented using program instructions that are processed sequentially during program execution.
- Design and construct instructions using a non-traditional, domain specific notation.
- Evaluate the clarity and legibility of instructions written in a nontraditional, domain-specific notation by reading and executing instructions created by others.
- Examine a number of common programming errors.
- Explore a number of common debugging strategies.
- Develop solution and strategies for correcting common programming errors.

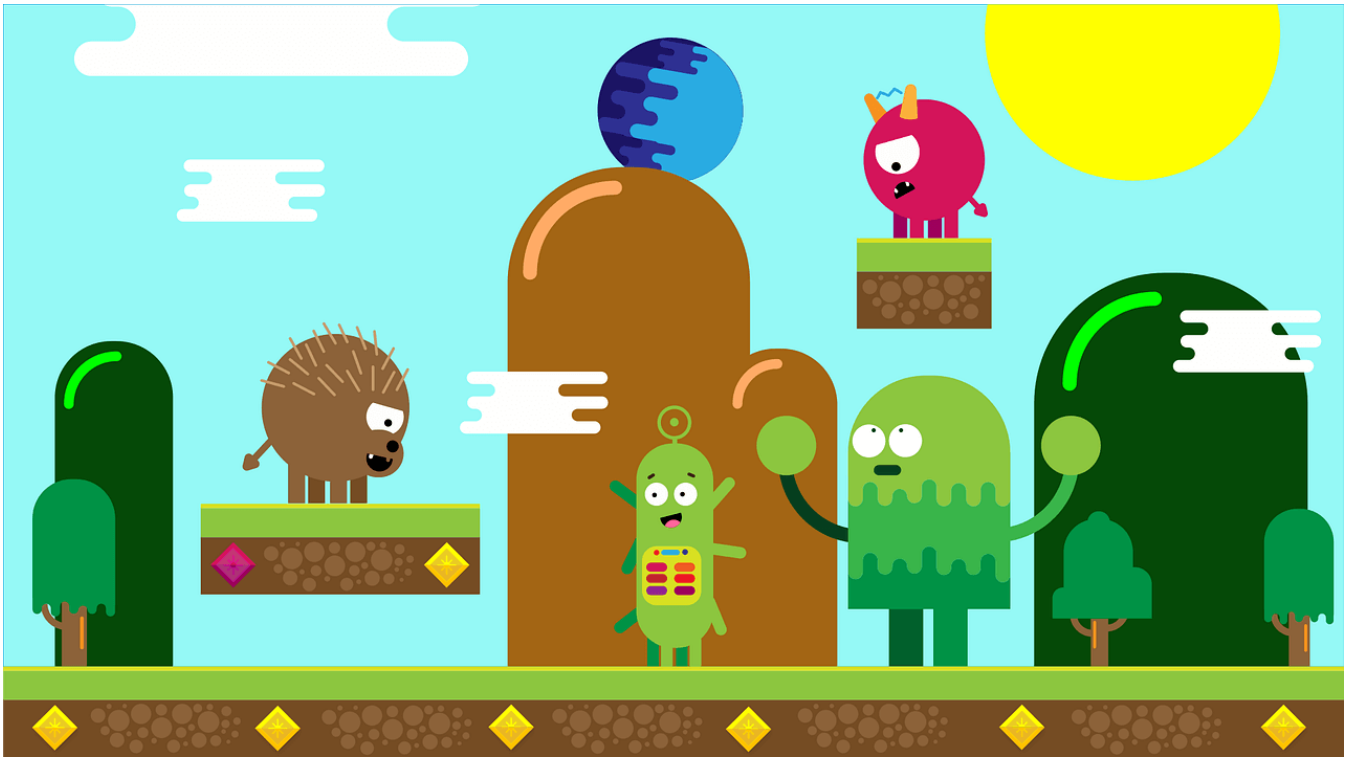
  - Code Studio Labs
  - Demonstrations

    - Flash Talk: students will prepare a talk on Net Neutrality, Internet Censorship, or Computer/Network Surveillance
    - Discussion Boards on the first 2 chapters of blown to bits. Using the course sites platform
    - Hands on Practice
    - Lectures
    - Powerpoint/ Prezi Presentations
- Building Projects is the best way to learn:

- ## Gamer Greg

  Greg wants to learn Python in order to build games for fun and loves puzzles.

  Greg has decided that he's going to learn Python by building games using the Pygame library. He'll start by building a structured project using some Pygame tutorials and then go onto create a simple version of Rock–paper–scissors before gradually increasing the complexity of his projects.



  Building a video game using Python

  Cool Python projects for game devs:

    - Rock, Paper, Scissors — Start your Python learning journey with a simple but fun game that everybody knows.
    - Build a Text Adventure Game — This is a classic Python beginner project (it also pops up in this book) that'll teach you a lot of basic game setup concepts that'll be useful for more advanced games in the future.
    - Guessing Game — This is another beginner-level project that'll help you learn and practice the basics.
    - Mad Libs — Learn how to make interactive Python Mad Libs!
    - Hangman — Another childhood classic that you can make in Python to stretch your skills.
    - Snake — This is a bit more complex, but it's a classic (and surprisingly fun) game to make and play.

s Guided Projects

Assessment Evidence - Checking for Understanding (CFU)

Quizzes

Exit Tickets

Evaluation rubrics

Formative Assessments	• Class discussions • Discussion boards • Exploratory activities • Quizzes • Student participation • Student presentation • Teacher observation and feedback
Summative assessments	• Code.org progress • Quizzes

- Admit Tickets
- Anticipation Guide
- Common Benchmarks
- Compare & Contrast
- Create a Multimedia Poster
- DBQ's
- Define
- Describe
- Evaluate
- Evaluation rubrics
- Exit Tickets
- Explaining
- Fist- to-Five or Thumb-Ometer
- Illustration

- Journals
- KWL Chart
- Learning Center Activities
- Multimedia Reports
- Newspaper Headline
- Outline
- Question Stems
- Quickwrite
- Quizzes
- Red Light, Green Light
- Self- assessments
- Socratic Seminar
- Study Guide
- Surveys
- Teacher Observation Checklist
- Think, Pair, Share
- Think, Write, Pair, Share
- Top 10 List
- Unit review/Test prep
- Unit tests
- Web-Based Assessments
- Written Reports

Primary Resources & Materials

Popfizz learning platform

A+ Learning Platform

Ancillary Resources

Real Python Learning Platform

Python.orgwww.w3schools.com/python/python_examples.asp

www.py4e.com/lessons

An Introduction to Python| A Python Tutorial (longbaonguyen.github.io)

https://pythonspot.com/

https://www.tutorialspoint.com/python/

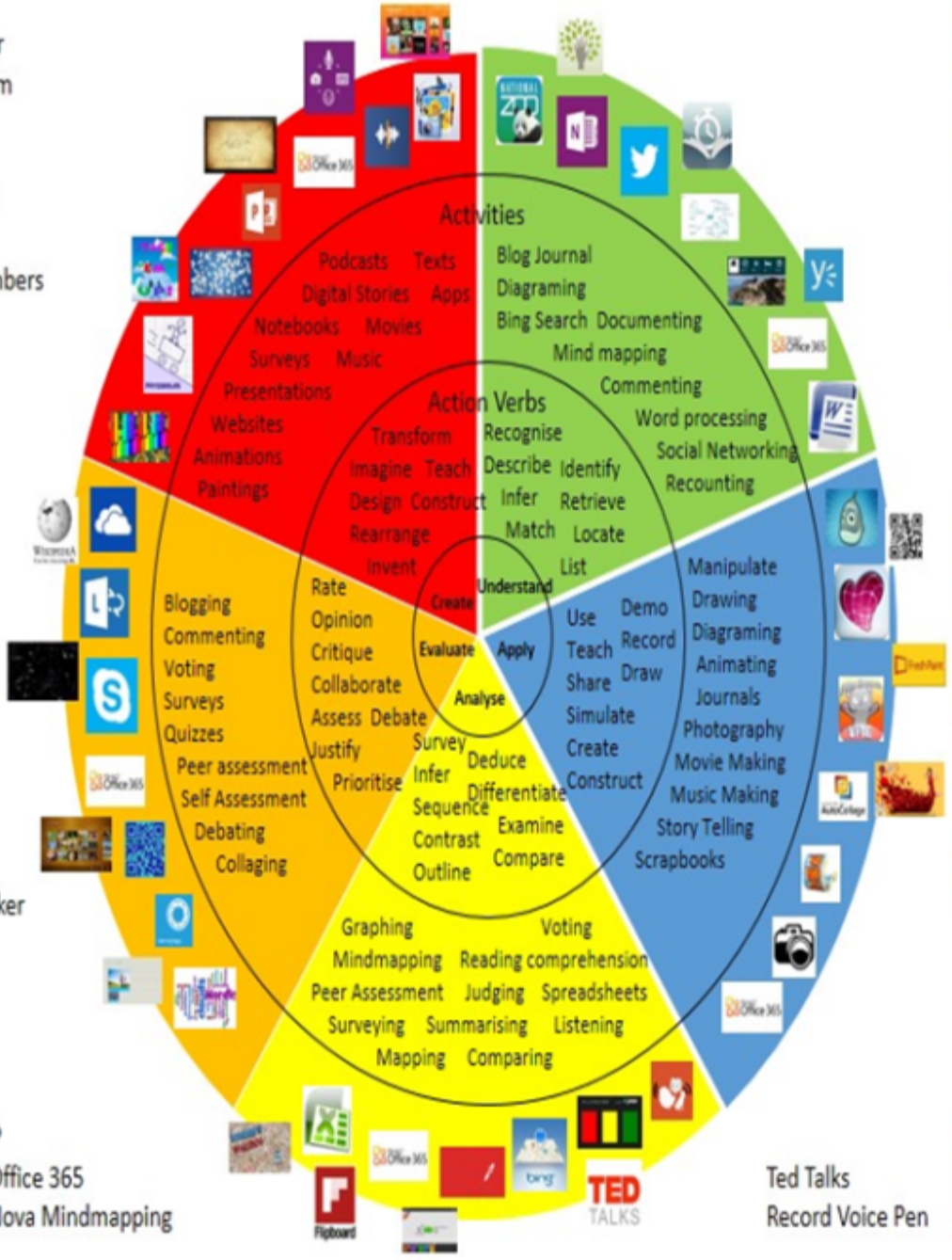
Technology Infusion

The Computer Science curriculum is solely technology infused.

Win 8.1 Apps/Tools Pedagogy Wheel

Podcasts
Photostory 3
Kid Story Builder
Music Maker Jam
Paint A Story
Office 365
MS PowerPoint
Stack 'Em Up
NqSquared Numbers
Physamajig
Xylophone 8

Wikipedia
Skydrive
Lync
SkyMap
Skype
Office 365
Puzzle Touch
Easy QR
Memorylage
Life Moments
Word Cloud Maker



Where's Waldo?
MS Excel Office 365
Flipboard Nova Mindmapping

Ted Talks
Record Voice Pen

Originally taken from http://www.coetail.com/vzimmer/files/2013/02/iPadagogy-Wheel.001.jpg
And adapted for Windows 8.1 devices by Charlotte Beckhurst @CharBeckhurst

Alignment to 21st Century Skills & Technology

21st Century Life and Careers 9.2.12.C.1 Review career goals and determine steps necessary for attainment. 9.2.12.C.3 Identify transferable career skills and design alternate career plans. 9.2.12.C.5 Research career opportunities in the United States and abroad that require knowledge of world languages and diverse cultures. 9.2.12.C.6 Investigate entrepreneurship opportunities as options for career planning and identify the knowledge, skills, abilities, and resources required for owning and managing a business. 9.3.IT-PRG.1 Analyze customer software needs and requirements. 9.3.IT-PRG.2 Demonstrate the use of industry standard strategies and project planning to meet customer specifications. 9.3.IT-PRG.3 Analyze system and software requirements to ensure maximum operating efficiency.

9.3.IT-PRG.4 Demonstrate the effective use of software development tools to develop software applications. 9.3.IT-PRG.5 Apply an appropriate software development process to design a software application. 9.3.IT-PRG.6 Program a computer application using the appropriate programming language. 9.3.IT-PRG.7 Demonstrate software testing procedures to ensure quality products. 9.3.IT-PRG.8 Perform quality assurance tasks as part of the software development cycle.

Mastery and infusion of 21st Century Skills & Technology and their Alignment to the core content areas is essential to student learning. The core content areas include:

- English Language Arts;
- Mathematics;
- Science and Scientific Inquiry (Next Generation);
- Social Studies, including American History, World History, Geography, Government and Civics, and Economics;
- World languages;
- Technology;
- Visual and Performing Arts.

21st Century Skills/Interdisciplinary Themes

0x CRP.K-12.CRP11 Use technology to enhance productivity.

0x CRP.K-12.CRP11.1	Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring new technology. They are proficient with ubiquitous technology applications. They understand the inherent risks-personal and organizational-of technology applications, and they take actions to prevent or mitigate these risks.
0x CRP.K-12.CRP2	Apply appropriate academic and technical skills.
0x CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
0x CRP.K-12.CRP4.1	Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.
0x CRP.K-12.CRP5	Consider the environmental, social and economic impacts of decisions.
0x CRP.K-12.CRP5.1	Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact and/or mitigate negative impact on other people, organization, and the environment. They are aware of and utilize new technologies, understandings, procedures, materials, and regulations affecting the nature of their work as it relates to the impact on the social condition, the environment and the profitability of the organization.
0x CRP.K-12.CRP6	Demonstrate creativity and innovation.
0x CRP.K-12.CRP6.1	Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.
0x CRP.K-12.CRP7	Employ valid and reliable research strategies.
0x CRP.K-12.CRP7.1	Career-ready individuals are discerning in accepting and using new information to make decisions, change practices or inform strategies. They use reliable research process to search for new information.

	They evaluate the validity of sources when considering the use and adoption of external information or practices in their workplace situation.
0x CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.

- Communication and Collaboration
- Creativity and Innovation
- Critical thinking and Problem Solving
- ICT (Information, Communications and Technology) Literacy
- Information Literacy
- Life and Career Skills
- Media Literacy

21st Century Skills

21st Century Skills that will be incorporated into this unit.

Critical Thinking & Problem Solving

Creativity and Innovation

Collaboration, Teamwork and Leadership

Cross-Cultural and Interpersonal Communication

Communication and Media Fluency

Accountability, Productivity and Ethics

- Civic Literacy
- Environmental Literacy
- Financial, Economic, Business and Entrepreneurial Literacy
- Global Awareness
- Health Literacy

Connections to Expressions, Equations, Modeling, and Coordinates.

Functions

Differentiation

Technology Resources • Teacher Tutoring • Peer Tutoring • Cooperative Learning Groups • Differentiated Instruction • Follow all IEP Modifications/504 Plan

Differentiations:

- Small group instruction
- Small group assignments
- Extra time to complete assignments
- Pairing oral instruction with visuals
- Repeat directions
- Use manipulatives
- Center-based instruction
- Token economy
- Study guides
- Teacher reads assessments allowed
- Scheduled breaks
- Rephrase written directions
- Multisensory approaches
- Additional time
- Preview vocabulary
- Preview content & concepts
- Story guides
- Behavior management plan
- Highlight text
- Student(s) work with assigned partner
- Visual presentation
- Assistive technology
- Auditory presentations
- Large print edition
- Dictation to scribe
- Small group setting

Hi-Prep Differentiations:

- Alternative formative and summative assessments
- Choice boards
- Games and tournaments
- Group investigations
- Guided Reading
- Independent research and projects
- Interest groups
- Learning contracts
- Leveled rubrics
- Literature circles
- Multiple intelligence options
- Multiple texts
- Personal agendas
- Project-based learning
- Problem-based learning
- Stations/centers
- Think-Tac-Toes
- Tiered activities/assignments
- Tiered products

- Varying organizers for instructions

Lo-Prep Differentiations

- Choice of books or activities
- Cubing activities
- Exploration by interest
- Flexible grouping
- Goal setting with students
- Jigsaw
- Mini workshops to re-teach or extend skills
- Open-ended activities
- Think-Pair-Share
- Reading buddies
- Varied journal prompts
- Varied supplemental materials

Special Education Learning (IEP's & 504's)

Special Education Learning adaptations that could possibly be employed in the unit, using the ones identified below.

Exemplar -Adapting existing materials, simplifying or supplementing materials

***Adjust** the method of presentation or content.*

- **Develop** supplemental material.
- **Tape-record** directions for the material.
- **Provide** alternatives for responding to questions.
- **Rewrite** brief sections to lower the reading level.
- **Outline** the material for the student before reading a selection.
- **Reduce** the number of pages or items on a page to be completed by thestudent.
- **Break** tasks into smaller subtasks.
- **Provide** additional practice to ensure mastery.
- **Substitute** a similar, less complex task for a particular assignment.
- **Develop** simple study guides to complement required materials.

Special Education Learning adaptations that could be employed in this unit,

- printed copy of board work/notes provided
- additional time for skill mastery
- assistive technology
- behavior management plan
- Center-Based Instruction
- check work frequently for understanding
- computer or electronic device utilizes
- extended time on tests/ quizzes
- have student repeat directions to check for understanding
- highlighted text visual presentation
- modified assignment format
- modified test content
- modified test format
- modified test length
- multi-sensory presentation
- multiple test sessions
- preferential seating
- preview of content, concepts, and vocabulary
- Provide modifications as dictated in the student's IEP/504 plan
- reduced/shortened reading assignments
- Reduced/shortened written assignments
- secure attention before giving instruction/directions
- shortened assignments
- student working with an assigned partner
- teacher initiated weekly assignment sheet
- Use open book, study guides, test prototypes

English Language Learning (ELL)

Exemplar:

*provide additional wait time for student responses to questions

When asked a question, ELL students typically translate it into their first language, formulate an answer in their first language, and translate an approximation of the answer into English, before giving their response. They accordingly need more time to respond than do students whose first language is English.

English Language Learning adaptations that will be employed in the unit, using the ones identified below.

Advance Notes

One way that we can make things easier is by preparing and distributing advance notes. This gives ELLs the opportunity to preview what will be taught and, in turn, aids in comprehension of the material.

- teaching key aspects of a topic. Eliminate nonessential information
- using videos, illustrations, pictures, and drawings to explain or clarif
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning;
- allowing students to correct errors (looking for understanding)
- allowing the use of note cards or open-book during testing
- decreasing the amount of workpresented or required
- having peers take notes or providing a copy of the teacher's notes
- modifying tests to reflect selected objectives
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers
- using computer word processing spell check and grammar check features
- using true/false, matching, or fill in the blank tests in lieu of essay tests

At Risk

Exemplar:
Caring, Sustained Relationships
One of the shortcomings of our educational structure is that relationships with teachers, especially in secondary school, may be caring, but they are not easy to sustain. Yet at-risk youth need relationships that are both caring and stable. They need to build a sense of trust and have the time to communicate the complexity, frustrations, and positive aspects of their lives in and out of school. Only after creating a strong relational base will an adult have the platform to be a source of enduring and cherished advice to a student. Students won't confer trust to an adult based on his or her role as a counselor, psychologist, or social worker. We have to earn it by building a relationship.

Parental Involvement
Planned intervention means involving parents. Do you have an agenda in place that goes home each night? Are parents also signing the agenda or contracts you have set up? How are you involving parental support at home for homework or additional follow up? Possible Intervention Strategies that will be employed in the unit, using the ones identified below.

- allowing students to correct errors (looking for understanding)
- teaching key aspects of a topic. Eliminate nonessential information
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning
- allowing students to select from given choices
- allowing the use of note cards or open-book during testing
- collaborating (general education teacher and specialist) to modify vocabulary, omit or modify items to reflect objectives for the student, eliminate sections of the test, and determine how the grade will be

determined prior to giving the test.

- decreasing the amount of workpresented or required
- having peers take notes or providing a copy of the teacher's notes
- marking students' correct and acceptable work, not the mistakes
- modifying tests to reflect selected objectives
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers
- using authentic assessments with real-life problem-solving
- using true/false, matching, or fill in the blank tests in lieu of essay tests
- using videos, illustrations, pictures, and drawings to explain or clarify

Talented and Gifted Learning (T&G)

http://www.grandviewlibrary.org/CurriculumAdaptations/General_Gifted.pdf

Grouping • Group gifted students with other gifted students or higher-level learners. • Refrain from grouping gifted students with lower-level students for remediation.

Exemplar:

Students will create a blog or social media page a topic of their choice within the unit

Talented and Gifted adaptations that will be employed in the unit, using the ones identified below.

- Above grade level placement option for qualified students
- Advanced problem-solving
- Allow students to work at a faster pace
- Cluster grouping
- Complete activities aligned with above grade level text using Benchmark results
- Create a blog or social media page about their unit
- Create a plan to solve an issue presented in the class or in a text
- Debate issues with research to support arguments
- Flexible skill grouping within a class or across grade level for rigor
- Higher order, critical & creative thinking skills, and discovery
- Multi-disciplinary unit and/or project
- Teacher-selected instructional strategies that are focused to provide challenge, engagement, and growth opportunities
- Utilize exploratory connections to higher-grade concepts

- Utilize project-based learning for greater depth of knowledge

Sample Lesson

Unit Name: **Computational Thinking - Unplugged**

NJSLS:

8.1 Educational Technology

8.1.12.D.1, 8.1.12.D.4, 8.1.12.F.2

8.2 Technology, Engineering, Design and Computational Thinking

8.2.12.A.1, 8.2.12.B.1, 8.2.12.B.3, 8.2.12.E.1, 8.2.12.F.1, 8.2.12.F.2, 8.2.12.F.3, 8.2.12.G.1

Interdisciplinary Connection:

- 21st century life and careers
- Technology
- Digital Literacy
- English Language Arts
- Reading
- Writing
- Speaking and Listening (communication skills)
- Mathematics
- Social science
- Science and the Engineering Practices

Career Ready Practices

- 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.
- CRP11. Use technology to enhance productivity.

Statement of Objective:

Students will:

- Analyze information to draw conclusions
- Match identical portions of similar phrases to match patterns
- Identify differences in similar phrases and abstract them out

Anticipatory Set/Do Now:

Review Vocabulary in Lesson:

This lesson has four new and important words:

Algorithm - A list of steps that you can follow to finish a task

Decompose - Break a problem down into smaller pieces

Abstraction - Pulling out specific differences to make one solution work for multiple problems

Pattern Matching - Finding similarities between things

After the Vocabulary words are reviewed then:

Figuring it Out

- Tell your students that you want them to sum up all of the numbers between 1 & 200.
    - Use your body language to indicate that this is not a "serious" or graded exercise.
        - Now, let them know that they must do it all in their heads.
        - Add the time constraint of thirty seconds.
        - They may feel overwhelmed. This is intentional. You can indicate with your tone and demeanor that you might be crazy asking this of them, but begin timing with a

resounding: "Starting NOW".

- Watch the class as you keep time. How many are lost in thought?
- When time is up, ask if anyone was able to get the total.
- Ask if there is anyone who thought the problem was so hard that they didn't even attempt it.
- Did anyone attempt it and just not finish?
    - What did they try?
- Guide students toward thinking a little smaller.
    - If we break the problem up into smaller pieces, it becomes easier to manage.
    - Let's start at the two ends. What is 200 + 1?
    - What is 199 + 2?
    - What is 198 + 3?
    - See a pattern?
    - How many of these pairs will we have?
        - What is the last pair we will find? 100 + 101
        - That means that we have 100 total pairs.
        - If we have 100 total pairs of sums of 201, how do we find the final total?
        - What is 100 * 201?
            - Now, what if we wanted to find the trick to do this with other numbers?
    - Can we do it easily with 2,000?
    - How about 20,000?
    - What stays the same? What is different?
    - If we use abstractions to make our end goal something that can change (say we name it "blank") then we can make an algorithm that will work for any number
- Work through the problem until you ultimately get ? = ("blank"/2) * ("blank"+1)
- Do a few simple examples to show that the algorithm is correct for blanks= 2, 3, 4, & 5.

"This is all to show that if you use the tools of Computational Thinking (decomposition, pattern matching, abstraction, and algorithms), then you can figure out how to solve problems that no one has already taught you how to solve...just like we did here! This will be an extremely powerful skill for the rest of your life!"

Learning Activity:

Computational Thinking - (see worksheet at)
https://code.org/curriculum/course3/1/Activity1-ComputationalThinking.pdf

This lesson is all about a "Game with No Instructions." Students will be charged with figuring out how to play the game as a small group. The small details of their final algorithm are unimportant. What *is* important is that they were able to take a huge task like "figuring out how to play a game on their own" and take small steps toward achieving the goal.

Students will be guided toward discovering the rules using the steps of computational thinking. Resist the temptation to point the students toward "doing it right" and allow them just to do it on their own. If they feel

stumped or confused, encourage the students to look at the information that has been given to them, or if they must, ask a classmate.

Directions:

1) Divide students into groups of 2-4.

2) Have the groups read over user experiences to get an idea of how other students have played the "Game with No Instructions."

3) Encourage them to pattern match between each experience by circling the sections of words that are identical from player to player.

4) Next, have them abstract away differences from each experience by underlining words that change from player to player.

5) Using pattern matching and abstraction, have them make a script template for game play by writing up the circled parts of the other students' experiences, and leaving the underlined sections as blanks. For example: 

6) Give students a blank sheet of paper to write a list of instructions for how they think this game should be played based on the user experiences that they just read. This will be their algorithm.

7) Have students play the game using the algorithm that they just made. Each player should get at least two turns.

Student Assessment/CFU's:

Formative Assessments	• Class discussions • Discussion boards • Exploratory activities • Quizzes • Student participation • Student presentation • Teacher observation and feedback
Summative assessments	• Code.org progress • Quizzes

Materials:

Computers, handouts. internet connection

Introduction videos:

https://www.youtube.com/watch?v=VFcUgSYyRPg

https://www.youtube.com/watch?v=mUXo-S7gzds

21st Century Themes and Skills:

21st century life and careers

Technology

Digital Literacy

Career Ready Practices

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.

CRP11. Use technology to enhance productivity.

Differentiation/Modifications:

- Project Based Learning
- Highlighting key vocabulary.
- Additional testing time.
- Using paired/cooperative learning.
- Using hands-on learning.
- Making curricular and personal connections.
- Developing oral, reading, and writing skills.
- Using graphic organizer and/note taking guides
- Use of technology for class
- Use of scaffolding and tiered assessments
- Other differentiation based on IEP and 504 accommodations

Integration of Technology:

Computers, Internet Connection, Smart Board

2nd Sample Lesson Plan

TIME: 45 MINS

Overview: Lesson introduces students to Booleans, Boolean operators and conditionals using a flowchart activity and short coding exercises.

Objective: Understanding True and False, combining True and False, and how computers make decisions using conditional statements and relating it to everyday decisions humans make every day.

Materials: Creative Coding in Python—Big Ideas: Pages 56, 59, 61.

Vocabulary: *Booleans*, *Boolean Operators* and *Conditionals*

INTRODUCTION (10 MINS)

Engage

- Throw out a few facts—ask students to tell if they are True or False.
- See Page 56 in book for ideas for this activity. Tell them that True and False are called *Booleans*.

Student Activity

- Why are they called Booleans?
- Scavenger hunt—have students find answer in the book (hint, page 56) or use Google to search.

Discussion

- Why do we need Booleans? What do we need them for? Used in conditionals. Use flowchart on Page 57 to demonstrate this.
- We can add and subtract numbers. Can we add True and False—discussion on Boolean Operators Page 59.

Coding Activity

- Enter Python code into the shell to demonstrate these ideas, Page 58, 60.
- We make decisions in our lives each day and so can computers. Give example of a conditional we use everyday, see example of making a decision for breakfast in the book on Page 61.

STUDENT UNPLUGGED ACTIVITY (10 MINS)

- Design an algorithm using a flowchart that uses a conditional—showing a decision you make every day.
- Write out a flowchart for a decision we could add to the ChatBot from Chapter 1 Project to make it better. Trade flowcharts with another student to see if they understand them.

STUDENT PLUGGED ACTIVITY (10 MINS)

Explain or read along on how Python does conditionals. Get students to enter examples from Page 62.

EXPERIMENT CODING TIME (10 MINS)

Continue to experiment with snippets of code by extending the previous example or adding conditionals to the Chat Bot project.

CLOSURE

Do a short assessment/ Exit Ticket—Ask students to answer what the computer prints at the end of the Python code for a ‘tuesday’ (on page 62) that uses conditionals.