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Unit Plan 3 - Variables, Expressions and Statements

Department of Curriculum and Instruction

Belleville Public Schools

Curriculum Guide

Introduction to Python - Computer Programming, Grades 9-12

Unit 3 Variables Expressions and Statements

Belleville Board of Education

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Unit Overview

Unit overview:

The goal of this unit is to teach students to think like a computer scientist. This way of thinking combines some of the best features of mathematics, engineering, and natural science. Like mathematicians, computer scientists use formal languages to denote ideas (specifically computations). Like engineers, they design things, assembling components into systems and evaluating tradeoffs among alternatives. Like scientists, they observe the behavior of complex systems, form hypotheses, and test predictions.

The single most important skill for a computer scientist is **problem solving**. Problem solving means the ability to formulate problems, think creatively about solutions, and express a solution clearly and accurately. As it turns out, the process of learning to program is an excellent opportunity to practice problem-solving skills. That's why this chapter is called, The way of the program.

On one level, students will be learning to program, a useful skill by itself. On another level,students will use programming as a means to an end

- **Students will learn:**

  What is a program, What is debugging?

- **Students will write their first program in Python**

- **Students will work with vaiables expressions and statements**

- **Students will understand that :**

A **value** is one of the fundamental things — like a letter or a number — that a program manipulates. The values we have seen so far are `4` (the result when we added `2 + 2`), and `"Hello, World!"`.

These values are classified into different **classes**, or **data types**: `4` is an *integer*, and `"Hello, World!"` is a *string*, so-called because it contains a string of letters.

Expressions in **Python** In **python**, an **expression** is any valid combination of **variables**, constants, literals and operators. It performs one or more operations with one or more operators, **variables** and literals. The type of operators and operands in the **expression** determines the type of **expression**.

Enduring Understanding

Coding is the backbone of almost every industry today. What you can do with computer science is unlimited. ● Python is a great language to start your journey as a computer scientist. It is straight-forward and important in the field of artificial intelligence. ● We code using the core concepts of every computer language, with just differences in syntax. ● Most coding is used to save time, everything could be created with the most basic commands, but that is not efficient.. ● Python is used to build everything from artificial intelligence to complicated websites. ● Most coding is used to save time, everything could be created with the most basic commands, but that is not efficient.. ● Python is used to build everything from artificial intelligence to complicated websites. ● Objects replicate things in real life. They make duplication

and creation of things in programs very efficient.

Essential Questions

● Why should we learn to code? ● Why learn the python language? ● How do we code in Python? ● Why do we need to learn methods and more complicated procedures in python? ● What can we build with python? ● How do we use objects?

Exit Skills

Students will be able to identify how coding is integrated into industry. ● Students will be able to identify specific uses of python. ● Students will understand the core ideas of python, including logic and comparison operators, data types, variables, number calculations, conditionals, and loops. ● Students will be able to use alternate methods to make their code more efficient ● Students will be able to create or improve an algorithm ● Students will understand the core ideas of python, including loops, lists, dictionaries, and processing data files. ● Students will be able to use alternate methods to make their code more efficient ● Students will be able to create or improve an algorithm ● Students will understand the core ideas of python, including functions and objects.

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.AP.4	Design and iteratively develop computational artifacts for practical intent, personal expression, or to address a societal issue.
CS.9-12.8.1.12.CS.1	Describe ways in which integrated systems hide underlying implementation details to simplify user experiences.
	Changes caused by the introduction and use of a new technology can range from gradual to rapid and from subtle to obvious, and can change over time. These changes may vary from society to society as a result of differences in a society's economy, politics, and culture.
	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

CAEP.9.2.12.C.1	Review career goals and determine steps necessary for attainment.
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.
	Functions

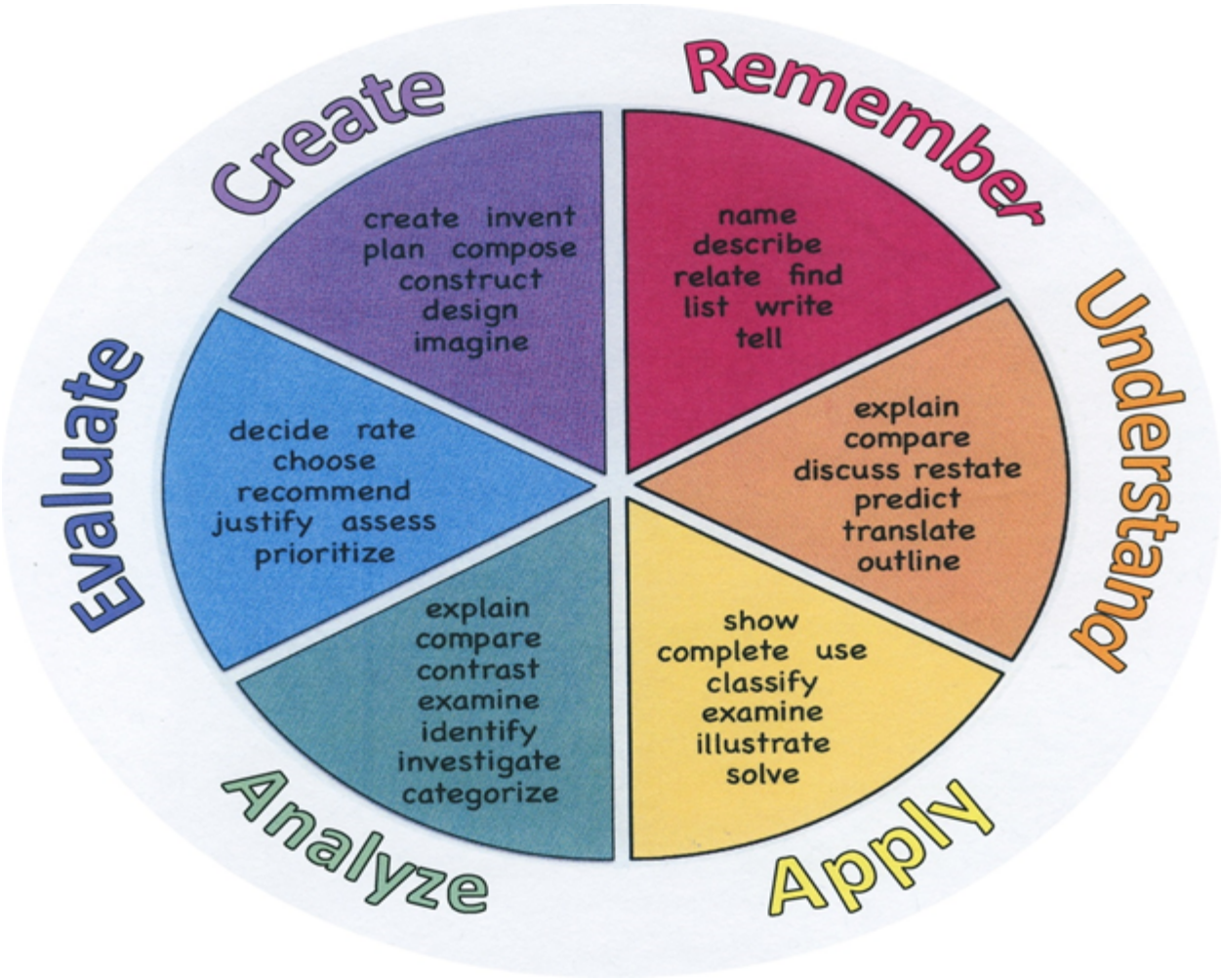
Learning Objectives

1. To acquire programming skills in core Python. 2. To acquire Object Oriented Skills in Python 3. To develop the skill of designing Graphical user Interfaces in Python 4. To develop the ability to write database applications in Python

Explain basic principles of Python programming language

A major focus of this class is developing problem solving skills. In an ef ort to build those skills, the instruction into programming in Python is infused with various problem solving activities. Generally given once a week, students explore dif erent problems designed to promote lateral thinking and develop their ability to analyze problems and revise solutions.

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

- Integrates problem- or project-based learning.
- PBL Name: The debugging nightmare! Goal: Students will analyze code to bug the bugs and fix the programs in time for release! Role: Coder Audience: teacher, classmates
- Situation: As a new coder for an emerging tech company, they've tasked you with debugging their code for their first release. Find the mistakes in time! Product: Students will present their solution to the bugged code through code samples and relaying the tactics they used. Standards: 8.1.12.CS.4: Develop guidelines that convey systematic troubleshooting strategies that others can use to identify and fix errors

Product: Students will present their projects to the class for evaluation Standards: 8.1.12.AP.4: Design and iteratively develop computational artifacts for practical intent, personal expression, or to address a societal issue.

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	• Progress checks • 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/

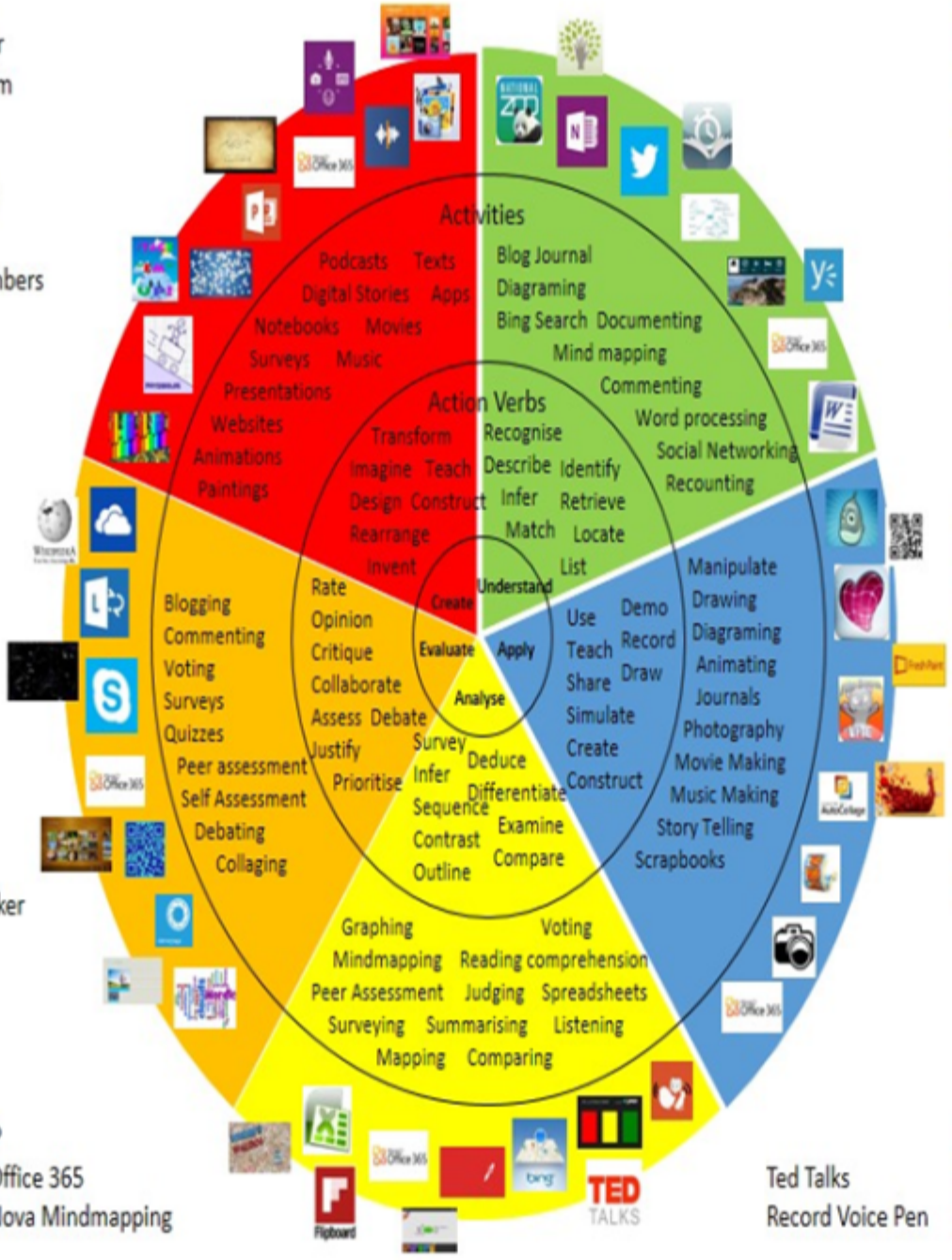
Technology Infusion

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
Flipboard
Office 365
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

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.

- 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
- multiple test sessions
- multi-sensory presentation
- 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:

*<u>provide additional wait time for student responses to questions</u>

• teaching key aspects of a topic. Eliminate nonessential information

0x • tutoring by peers

0x • having peers take notes or providing a copy of the teacher's notes

0x • providing study guides

0x • allowing students to correct errors (looking for understanding)

0x • using computer word processing spell check and grammar check feature

- 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

First Program

Introduction

In this lesson, students will jump in and see how Python works. They will learn the “print” command and experiment with syntax that will or will not work.

The students will:

- Be able to define output, correctly utilize the print command
- Create their first program

Components:

- Video Lesson
- Lesson Practice
- Code Practice (3)

What to Emphasize:

- Print statements can use pairs of single and double quotes. Although one is not technically preferred over another, double quotes are probably the usual choice of programmers.
- Syntax is super important when it comes to programming. Although it seems silly now that the space between the text “Hello “ and the plus sign is ignored, other times, spacing (indenting) will be very important for a program to run correctly.

Additional Notes:

It is nice that the programming environment uses colors for different parts of the code: commands, comments, string literals, etc. However, be aware that some students with color blindness may have difficulty using the different colors while they code. Referring to the “red text” if the text is inputted correctly will not help them, and finding and sharing other techniques for debugging will be useful to them.

Curricular Standards

This lesson adheres to the following CSTA Standards: 3A-AP-18