Unit 2 Control Statements & Loops

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AP Computer Science A - Java

Department of Curriculum and Instruction

Belleville Public Schools

Curriculum Guide

AP Computer Science A -Java

Unit 2 – Control Statements & Loops

Belleville Board of Education

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Unit Overview

Unit Overview :

- Control statements and loops provide a program with the ability to select whether to run segments of code based on user input or satisfied conditions

Variables within control statements and loops cannot be used throughout the entire program

Loops are useful for complex or repetitive tasks.

The Java If Statement

What is a **Java if statement**? Well, even though it is possible to write an application that just performs a set of steps, that wouldn't be very interesting or allow us to do very much. Life is full of choices, and the outcome of each choice is conditional on which choice we make. When we encounter an 'if', something may or may not happen. Life's many 'ifs' are a lot like forks in the road, and it's those forks which may or may not be taken that make life interesting.

Computer applications want to be interesting too, so computer languages like Java offer forks in their roads too, which are called conditional statements. So, think of the Java if statement like one of life's forks in the

road --a decision must be made because the program can't take both roads.

Enduring Understanding

- How to write all forms of if-else statements
- How to write all forms of for and while loops
- The similarities and difference of for and while loops
- The various types of operators and their purposes

Essential Questions

Essential Questions

(What questions will the student be able to answer as a result of the instruction?)

1. How do arithmetic, relational, and logical operators differ? How are they the same?
2. How can appropriately used control statements and loops control the output of program?
3. How do for and while loops vary?
4. How can selection control be implemented using nested if-else statements?
5. How can using multiple conditions using logic operators in an if-else statement benefit the program?
6. How can various math functions be called to when needed?

Exit Skills

Exit Skills - Assessment

- Complete various written checkpoint exercises that focus on the explanation and description of computer basics.
- Develop a visual representation of the communication processes within a computer using appropriate ter
- Properly document a program using correct indentation, spacing, and comment style.
- Debug programs and determine the types of errors in the program.

- Create programs based on programming exercises that display various types of output using string and n
- Unit 1 Assessment

Formative Evaluations:	**Summati**
Formative Assessment with polling codeIt! Nows Quizzes Long Programs (LP)/Lab Work	Unit 1 Te

Sequence and Scope

Day	***Topic/Activities***	
1	- **Assignment & Increment Operators** - **Relational & Logical Operators** - codeIt! Now	
2	- *Quiz Question #1 & #2* - **The if-else Statement** - codeIt! Now	
3	- **Nested if-else Statement** - codeIt! Now	I
4	- *Quiz Question #3* - **The while Loop** - codeIt! Now	
5	- finish **while Loops** - *Lab Work: Long Program #1 (LP)*	
6	- *Lab Work: LP #1*	
7	- *Quiz Question #4 & #5*	
8	- **The for Loop** - codeIt! Now	Pro
9	- *Lab Work: LP #2*	
10	- *Lab Work: LP #2*	
11	- *Quiz Question #6* - *Lab Work (makeup lab work with remaining time)*	I
12	- **Nest for & while Loops** - codeIt! Now	I
13	- *Lab Work: LP #3*	I
14	- *Lab Work: LP #3*	I
15	- *Lab Work: LP #3*	

16	- Unit 1 Assessment	

New Jersey Student Learning Standards (NJSLS-S)

CSTA Standards
Computing Systems
• 3A-CS-03 Develop guidelines that convey systematic troubleshooting strategies that others can use to id • 3B-CS-02 Illustrate ways computing systems implement logic, input, and output through hardware comp
Networks and the Internet
• 3B-NI-03 Describe the issues that impact network functionality (e.g., bandwidth, load, delay, topology). • 3B-NI-04 Compare ways software developers protect devices and information from unauthorized access
Data and Analysis
• 3A-DA-09 Translate between different bit representations of real-world phenomena, such as characters, • 3A-DA-10 Evaluate the tradeoffs in how data elements are organized and where data is stored. • 3B-DA-06 Select data collection tools and techniques to generate data sets that support a claim or comm • 3B-DA-07 Evaluate the ability of models and simulations to test and support the refinement of hypothes
Algorithms and Programming
• 3A-AP-13 Create prototypes that use algorithms to solve computational problems by leveraging prior stu

personal interests.
- 3A-AP-15 Justify the selection of specific control structures when tradeoffs involve implementation, rea performance, and explain the benefits and drawbacks of choices made.

3A-AP-17 Decompose problems into smaller components through systematic analysis, using constructs such as and/or objects.

- 3A-AP-18 Create artifacts by using procedures within a program, combinations of data and procedures, interrelated programs.
- 3A-AP-19 Systematically design and develop programs for broad audiences by incorporating feedback f
- 3A-AP-22 Design and develop computational artifacts working in team roles using collaborative tools.
- 3A-AP-23 Document design decisions using text, graphics, presentations, and/or demonstrations in the d programs.
- 3B-AP-10 Use and adapt classic algorithms to solve computational problems.
- 3B-AP-11 Evaluate algorithms in terms of their efficiency, correctness, and clarity.
- 3B-AP-12 Compare and contrast fundamental data structures and their uses.
- 3B-AP-14 Construct solutions to problems using student-created components, such as procedures, modu
- 3B-AP-20 Use version control systems, integrated development environments (IDEs), and collaborative documentation) in a group software project.
- 3B-AP-21 Develop and use a series of test cases to verify that a program performs according to its desig
- 3B-AP-22 Modify an existing program to add additional functionality and discuss intended and unintend breaking other functionality).
- 3B-AP-23 Evaluate key qualities of a program through a process such as a code review.

Impacts of Computing

- 3A-IC-24 Evaluate the ways computing impacts personal, ethical, social, economic, and cultural practice
- 3A-IC-25 Test and refine computational artifacts to reduce bias and equity deficits.
- 3A-IC-26 Demonstrate ways a given algorithm applies to problems across disciplines.

TECH.8.2.12	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.
TECH.8.2.12.E	Computational Thinking: Programming: Computational thinking builds and enhances problem solving, allowing students to move beyond using knowledge to creating knowledge.
	Functions

Interdisciplinary Connections

Primary interdisciplinary connections:

Infused within the unit are connections to the 2016 NJSLS for Language Arts Literacy and Business, Science and Technology.

Critical reading, writing, and mathematical modeling skills are promoted within the problem solving process and as a means to explain solutions.

Learning Objectives

- Select and implement operators as conditions within control statements and loops.
- Declare, initialize and organize variables within loops
- Create control statements and loops to provide the ability for varied outcomes within a program by selecting which code segments run.
- Explain the differences between syntax errors, runtime errors, and logic errors
- Analyze and evaluate variables within a loop compared to those outside the loop.
- Write programs to perform simple computations using control statements and loops
- Generate random numbers and use various other Math Library commands
- Understand the similarities and differences between types of loops and how to vary their use.

Suggested Activities & Best Practices

Assignment Ideas

- **CS Unplugged**
- **CS Fundamentals Unplugged** from Code.org
- **CS4K12** Collection of handouts, worksheets and other documents to help teach Computer Science and Engineering concepts. Materials primarily target middle-school students (6th - 8th grade), but most can be used without modification for younger or older students.
- **Code.org YouTube Channel** > Learn about computer science
- **Nifty Assignments** Collection of fun, inspirational, or thought-provoking assignments for CS1 and CS2 shared at the annual SIGCSE conference

- **EngageCSEdu** Collection of activities and programming assignments designed to engage ALL students in CS1- and CS2-level courses. Materials have been reviewed by computer science educators and experts in student engagement and pedagogy.
- **Websheets** A system for creating and solving programming assignments **About Websheets**
- **Stanford CS Education Library** Education CS material from Stanford CS classes
- **Learn Java in N Games** Collection of game-based activities (including POGIL-style activities) for learning about Java programming. Can be used individually or as a complete curriculum. CS2 level.

Best Practices

- **CS Teaching Tips** Tips to help teachers anticipate students' difficulties and build upon students' strengths. Funded by a National Science Foundation Grant.
- http://www.abovenv.com/wp-content/uploads/2016/08/DroneBlocksLesson3IntroductiontoLoops.pdf

Assessment Evidence - Checking for Understanding (CFU)

Formative Assessments • Think, pair, share review questions from text. • Practice mini-programs to strengthen concepts as taught.
• Teacher Observation • Utilizing Gliffy.com to flowchart programs
Summative Assessments • Chapter Test • End of Chapter Projects from book.

example: https://quizlet.com/76598385/ap-computer-science-a-flash-cards/

http://www.abovenv.com/wp-content/uploads/2016/08/DroneBlocksLesson3IntroductiontoLoops.pdf

https://runestone.academy/runestone/books/published/csawesome/Unit4-Iteration/topic-4-1-while-loops.html#groupwork-programming-challenge-guessing-game

Alternate Assessment * Written reports

Benchmark Assessment * Create a Multimedia poster

- 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

NJCTL Curriculum

Curriculum development Resources/Instructional Materials/Equipment Needed Teacher Resources: •

www.gliffy.com • Eclipse IDE • MS DOS Prompt • Computers

Ancillary Resources

Java Resources

- Java Review for the AP CS A Exam - Great review site with lots of practice questions.
- Aplus Compter Science Exam Review Material -Slide, Free Response, and more!
- Introduction to Java - a textbook for a first course in computer science for the next generation of scientists and engineers
- Guru-99 Introduction Java Material
- Oracles (owners of Java) has their own tutorials
- Dick Baldwin - ACC - Introduction and Advanced Java Material
- Introduction to Computer Science using Java - by Bradley Kjell
- Thinking in Java
- Blue Pelican Java
- Java Coding Bat - Lots of good practice problems
- Code Academy - No Java but good practice.

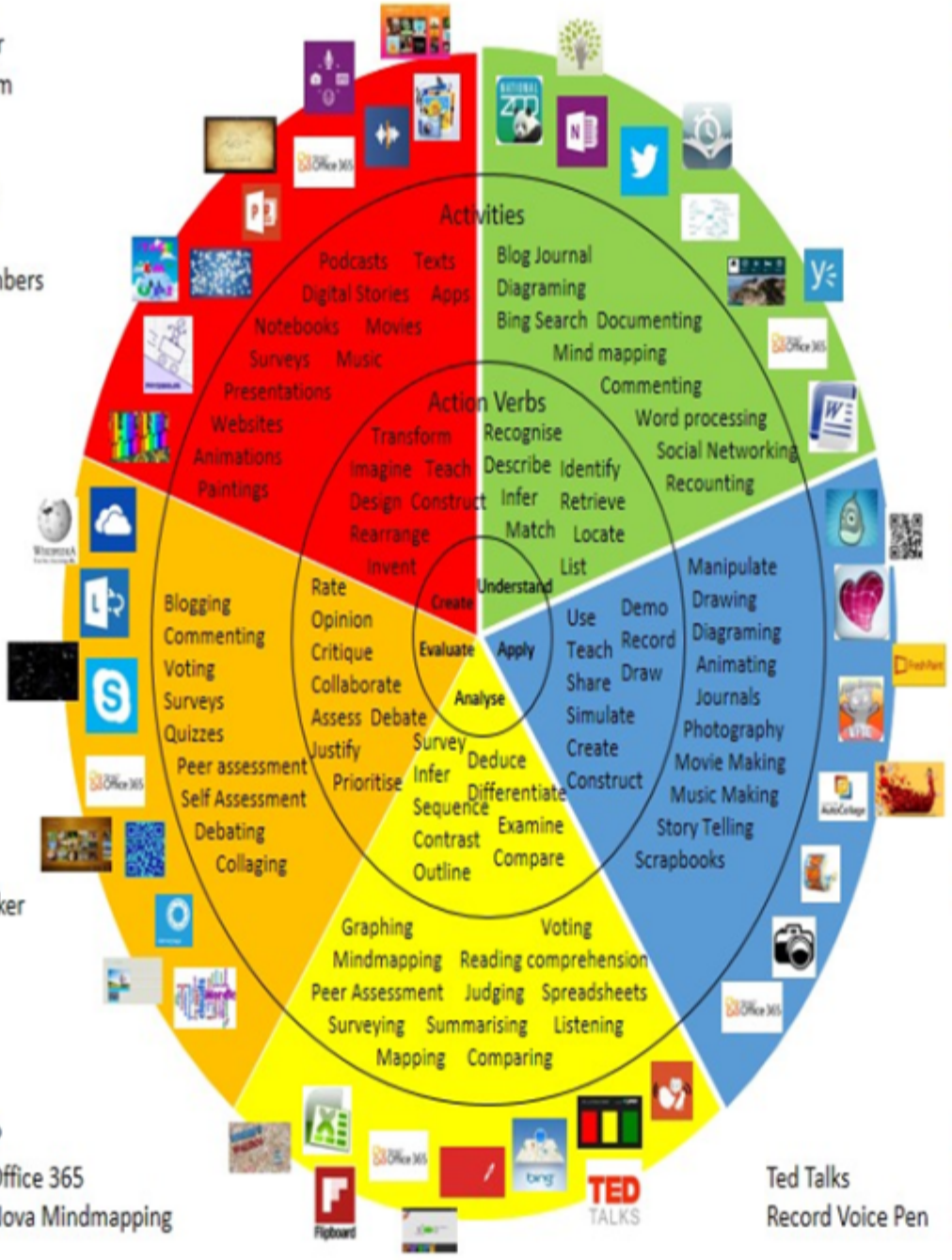
Technology Infusion

Technology Infusion and/or strategies include chromebooks online materials google/powerpoint slides

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 themes: The unit will integrate the 21st Century Life and career standard 9.1 strands A-D. These strands include: critical thinking and problem solving, creativity and innovation, collaboration, teamwork, and leadership, and cross cultural understanding and interpersonal communication

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.

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.CS1	Understand and use technology systems.

21st Century Skills/Interdisciplinary Themes

21st century themes: The unit will integrate the 21st Century Life and career standard 9.1 strands A-D. These strands include: critical thinking and problem solving, creativity and innovation, collaboration, teamwork, and leadership, and cross cultural understanding and interpersonal communication

21st Century/Interdisciplinary Themes that will be incorporated into this unit.

- 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

The set of inputs to a function is called its domain. We often infer the domain to be all

inputs for which the expression defining a function has a value, or for which the function makes sense in a given context.

Functions presented as expressions can model many important phenomena. Two important families of functions characterized by laws of growth are linear functions, which grow at a constant rate, and exponential functions, which grow at a constant percent rate. Linear functions with a constant term of zero describe proportional relationships.

A function can be described in various ways, such as by a graph (e.g., the trace of a seismograph); by a verbal rule, as in, “I’ll give you a state, you give me the capital city;” by an algebraic expression like f(x) = a + bx; or by a recursive rule. The graph of a function is often a useful way of visualizing the relationship of the function models, and manipulating a mathematical expression for a function can throw light on the function’s properties.

21st Century Skills

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

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

TECH.K-12.1.1	Empowered Learner
TECH.K-12.1.2	Digital Citizen
TECH.K-12.1.5	Computational Thinker
TECH.K-12.1.5.a	formulate problem definitions suited for technology-assisted methods such as data analysis, abstract models and algorithmic thinking in exploring and finding solutions.
TECH.K-12.1.5.b	collect data or identify relevant data sets, use digital tools to analyze them, and represent data in various ways to facilitate problem-solving and decision-making.
TECH.K-12.1.5.c	break problems into component parts, extract key information, and develop descriptive models to understand complex systems or facilitate problem-solving.
TECH.K-12.1.5.d	understand how automation works and use algorithmic thinking to develop a sequence of steps to create and test automated solutions.

Differentiation

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

Think-pair share is a great way of differentiating instruction

These are the 12 best differentiated instruction strategies to help you better meet the needs of all of your students:

1. Group students based on knowledge
2. Create pods with student captains

3. Create tiered lessons
4. Create handouts for common questions
5. Include hands-on activities and projects
6. Provide study guides, worksheets, and notes
7. Flip your classroom
8. Leverage your students' strengths
9. Practice flexible grouping
10. Offer more choices for learning
11. Think-pair-share
12. Try digital curriculum

Differentiation in a lesson lies within content, process, and/or product.

Differentiations:

- Extra time to complete assignments
- Pairing oral instruction with visuals
- Study guides
- Preview vocabulary
- Preview content & concepts
- 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
- Mini workshops to re-teach or extend skills

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

Adapting existing materials, simplifying or supplementing materials

Breaking tasks into smaller subtasks is a an accomodation I have had success with.

- **Adjust** the method of presentation or content.
- **Develop** supplemental material.

- 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)

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.

Extended Time

It's obvious that response time for ELLs is significantly greater than it is for students proficient in English. Given this, we know that ELLs may require more time to process and communicate information on assessments. To support your students in this area, give them additional time on tests to help. Extra time will

also help to decrease anxiety, which often has a significant impact on test performance.

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

- 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

Directions or Instructions

Make sure directions and/or instructions are given in limited numbers. Give directions/instructions verbally and in simple written format. Ask students to repeat the instructions or directions to ensure understanding occurs. Check back with the student to ensure he/she hasn't forgotten. It is a rare event for students at risk to be able to remember more than 3 things at once. Chunk your information, when 2 things are done, move to the next two.

Peer Support

Sometimes, all you have to do is assign a peer to help keep a student at risk on task. Peers can help build confidence in other students by assisting in peer learning. Many teachers use the 'ask 3 before me' approach. This is fine, however, a student at risk may have to have a specific student or two to ask. Set this up for the student so he/she knows who to ask for clarification before going to you.

- 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.

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

https://runestone.academy/runestone/books/published/csawesome/Unit4-Iteration/topic-4-1-while-loops.html#groupwork-programming-challenge-guessing-game

Using the template below, please develop a **Sample Lesson** for the first unit only.

Unit Name:

NJSLS:

Interdisciplinary Connection:

Statement of Objective:

Anticipatory Set/Do Now:

Learning Activity:

Student Assessment/CFU's:

Materials:

21st Century Themes and Skills:

Differentiation/Modifications:

Integration of Technology: