Unit 2: Programming

Content Area: **Technology**
Course(s): **Sample Course**
Time Period: **OctNov**
Length: **Full Year, 10-12**
Status: **Published**

Computer Science Principles

Department of Curriculum and Instruction

Belleville Public Schools

Curriculum Guide

Computer Science Principles, Grades 10-12

Unit 2, Programming

Belleville Board of Education

102 Passaic Avenue

Belleville, NJ 07109

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 K-8, ESL Coordinator K-12

Mr. George Droste, Director of Secondary Education

Board Approved:

Unit Overview

Use of a programming environment to explore sequencing, selection, and iteration as part of the goal to create programs that serve useful functions.

Enduring Understanding

- Computing facilitates exploration and the creation of computational artifacts and new knowledge that help people solve personal, societal, and global problems.
- Computing allows people to use creative development processes to produce computational artifacts for creative expression or to solve a problem.
- Computing has global effects both beneficial and harmful on people and society.

Essential Questions

- How are programs developed to help people, organizations, or society solve problems?
- How does abstraction make the development of computer programs possible?

Exit Skills

Students will be able to:

Visual Programming:

- Utilize a graphical editor to read, construct, and execute dynamic programs.
- Assess, modify, and execute programs developed by others.
- Examine how well-specified behavior of objects can be constructed through sequential actions and operations.

Program State:

- Develop a variety of programs using methods and techniques that are appropriate for the goals of the programmer.
- Create programs that incorporate dynamic, user-driven, keyboard controls and input.
- Experiment with how the dynamic state of an object or program can be stored and changed using variables.
- Analyze the role of clear, descriptive names for objects, behaviors, variables, and other identifiers in maintaining the readability of code.
- Identify additional desired outcomes for a program that extend beyond its original purpose.

Selection Statements:

- Examine the uses of selection statements in programming.
- Analyze the differences between simple selection and complex, nested selection statements.
- Constructing complex conditional statements with the use of the Boolean operators "AND", "OR", and "NOT" in coding.

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.

Global Impact:

- Examine and discuss the motivations behind a number of high profile individuals in the field of programming.
- Discuss the benefits of programming as a tool and a profession.

Analyze the legal and ethical concerns of open source and licensed software, libraries, and code.

New Jersey Student Learning Standards (NJSLS-S)

8.1 Educational Technology

8.1.12.B.1, 8.1.12.C.1, 8.1.12.D.1, 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.E.1, 8.2.12.E.2, 8.2.12.E.3, 8.2.12.E.4, 8.2.12.F.1, 8.2.12.F.2, 8.2.12.F.3

Interdisciplinary Connections

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

- Develop a variety of programs using methods and techniques that are appropriate for the goals of the programmer.
- Create programs that incorporate dynamic, user-driven, keyboard controls and input.
- Experiment with how the dynamic state of an object or program can be stored and changed using variables.
- Analyze the role of clear, descriptive names for objects, behaviors, variables, and other identifiers in maintaining the readability of code.
- Identify additional desired outcomes for a program that extend beyond its original purpose.

Suggested Activities & Best Practices

Visual Programming:

- Utilize a graphical editor to read, construct, and execute dynamic programs.
- Assess, modify, and execute programs developed by others.
- Examine how well-specified behavior of objects can be constructed through sequential actions and operations.

Program State:

Develop a variety of programs using methods and techniques that are appropriate for the goals of the programmer.

- Create programs that incorporate dynamic, user-driven, keyboard controls and input.
- Experiment with how the dynamic state of an object or program can be stored and changed using variables.

- Analyze the role of clear, descriptive names for objects, behaviors, variables, and other identifiers in maintaining the readability of code.
- Identify additional desired outcomes for a program that extend beyond its original purpose.

Selection Statements:

- Examine the uses of selection statements in programming.
- Analyze the differences between simple selection and complex, nested selection statements.
- Constructing complex conditional statements with the use of the Boolean operators "AND", "OR", and "NOT" in coding.

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.

Global Impact:

- Examine and discuss the motivations behind a number of high profile individuals in the field of programming.
- Discuss the benefits of programming as a tool and a profession.
- Analyze the legal and ethical concerns of open source and licensed software, libraries, and code.

Assessment Evidence - Checking for Understanding (CFU)

Upon completion of this section, please remove all remaining descriptions, notes, outlines, examples and/or illustrations that are not needed or used.

By identifying the **Evidence of Student Learning with Checking for Understanding (CFU)** techniques used during the lesson and/or for Closure (Madeline Hunter), please list the variety of means used to access students' learning (e.g. quizzes, tests, academic prompts, observations, homework, journals).

- 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

Primary Resources:

 Edhesive Online Training
Code.Org Online Training

Computers and Internet Access
AP Central at Collegeboard.org
Massive Open Online Course
Code.org
Multimedia Applications Tools
Abelson, H., Ledeen, K., and Lewis, H. R. Blown to Bits: your life, liberty, and happiness after the digital explosion. Upper Saddle River, N.J.: Addison-Wesley, 2008.

Ancillary Resources

AP Approved Programming Resources:

 Alice - This 3-D modeling environment allows students to create and animate 3-D worlds. This environment lends itself well to creating stories and games.

App Inventor - This open-source Web application allows students to create their own applications on mobile devices. App Lab - This is a programming environment for creating web applications with JavaScript. It allows students to develop programs and toggle back and forth between block-based and text-based programming modes.
EarSketch - This browser-based application allows students to create their own music using either JavaScript or Python. Greenfoot - This Java IDE is designed for use in education to create two-dimensional graphic applications, such as simulations and interactive games.
Java - There are several IDEs that can be used to write in Java. The Java language allows students to create and solve problems that vary widely in difficulty.
JavaScript - This language is commonly used to create interactive effects within Web browsers.
Lego Mindstorms NXT - This product integrates programming with Lego bricks and sensors to create and program robots. The instructions are assembled by linking together function blocks.
Processing - This programming language was initially created to serve as a software sketchbook, and it can be used to teach programming using a visual context.
Python - This language has the benefit of readability that might be helpful to new programmers.

Scratch - This blocks-based programming language allows students to build scripts to run animations. This product can be downloaded and installed on a computer or run in the browser.

Snap! - This Scratch-style programming language is block-based and allows users to define new primitives in JavaScript. Users can read and write information from the Internet using server-defined APIs and make mobile applications.

Swift - This programming language is designed for use with iOS, OS X, tvOS and watchOS. This environment allows students to create their own Apple apps and includes interactive environments that allow students to see the effects of changes or additions to code as they type.

Design and Development Process:

What Is the Software Development Life Cycle?" Official Blog Airbrake Bug Tracker. https://airbrake.io/blog/insight/what-is-the-software-development-life-cycle

"Engineering Design Process." https://www.teachengineering.org/ engrdesignprocess.php

"The Engineering Design Process." http://www.eie.org/overview/engineeringdesign-process Mohammed, Nabil, Ali Munassar, and A. Govardhan.

"A Comparison Between Five Models of Software Engineering." IJCSI International Journal of Computer Science 7.5 (2010): 94-101.

Open Source:

"What Is Open Source?" Opensource.com. https://opensource.com/resources/whatopen-source

Open Source Initiative. http://opensource.org/

Technology Infusion

Upon completion of this sections, please remove all remaining descriptions, notes, outlines, examples and/or illustrations that are not needed or used.

What **Technology Infusion** and/or strategies are integrated into this unit to enhance learning? Please list all hardware, software and strategies. Please find a technology pedagogy wheel for assistance while completing this section.

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

Activities
Podcasts   Texts
Digital Stories   Apps
Notebooks   Movies
Surveys   Music
Presentations
Websites
Animations
Paintings

Blog Journal
Diagraming
Bing Search   Documenting
Mind mapping
Commenting
Word processing
Social Networking
Recounting

Action Verbs
Transform   Recognise
Imagine   Teach   Describe   Identify
Design   Construct   Infer   Retrieve
Rearrange   Match   Locate
Invent   List

Rate   Understand
Opinion   Create   Use   Demo
Critique   Evaluate   Apply   Teach   Record
Collaborate   Analyse   Share   Draw
Assess   Debate   Simulate
Justify   Survey   Deduce   Create
Prioritise   Infer   Differentiate   Construct
Sequence
Contrast   Examine
Outline   Compare

Blogging
Commenting
Voting
Surveys
Quizzes
Peer assessment
Self Assessment
Debating
Collaging

Manipulate
Drawing
Diagraming
Animating
Journals
Photography
Movie Making
Music Making
Story Telling
Scrapbooks

Graphing   Voting
Mindmapping   Reading comprehension
Peer Assessment   Judging   Spreadsheets
Surveying   Summarising   Listening
Mapping   Comparing

Alignment to 21st Century Skills & Technology

Upon completion of this section, please remove all remaining descriptions, notes, outlines, examples and/or illustrations that are not needed or used.

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

Upon completion of this section, please remove all remaining descriptions, notes, outlines, examples and/or illustrations that are not needed or used.

Please list only the **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

21st Century Skills

Upon completion of this section, please remove all remaining descriptions, notes, outlines, examples and/or illustrations that are not needed or used.

Please list only the **21st Century Skills** that will be incorporated into this unit.

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

Differentiation

Upon completion of this section, please remove all remaining descriptions, notes, outlines, examples and/or illustrations that are not needed or used.

Please remember: Effective educational **Differentiation** in a lesson lies within content, process, and/or product.

Please identify the ones that will be employed in this unit.

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)

Please identify the **Special Education Learning** adaptations that will be employed in the unit, using the ones identified below.

- 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)

Please identify the **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

Please identify 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)

Please identify the **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

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: