Unit 1: Computational Thinking

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Computer Science, Computational Thinking

Department of Curriculum and Instruction

Belleville Public Schools

Curriculum Guide

Computer Science Principles

Computational Thinking

Belleville Board of Education

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Unit Overview

Introduction to computational thinking, logical reasoning, and describing processes through algorithms and pseudocode.

Upon completion of this unit students will be able to: Identify and use a graphical blocks-based programming language (Scratch) to implement algorithms. Identify Google sites portfolio as an example of cloud computing. Create a Google sites portfolio that they will use during the course to post their work. Clearly communicate with a global audience about personal ideas. Understand how humans and computers interact through different languages. Identify and use the App Inventor program to create a very basic application.

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.

Essential Questions

- What kinds of problems are easy, difficult, or impossible to solve algorithmically?
- How are algorithms created and evaluated?
- How are programs used for creative expression, to satisfy personal curiosity, or to create new knowledge?

Exit Skills

Algorithmic Thinking:

- Examine strategies for approaching large-scale problems and the applications of employing a top-down approach as well as a bottom-up approach to problem solving.
- Identify and examine a number of common features of algorithms, including sequencing, selection, and repetition.
- Compare the differences between sequential search and binary search algorithms.
- Design and evaluate a sorting algorithm.
- Compare the methods and relative efficiencies of different sorting algorithms.

Programming Languages:

- Incorporate clarity and precision in communicating an algorithmic solution to a problem.

- Examine the shortcomings and ambiguities of natural languages.
- Identify the elements of clear communication, including grammar, vocabulary, and syntax.
- Compare and contrast high-level languages with low-level language by examining the process in which a program is written in a high-level language, compiled into a low-level language, loaded into memory, and executed by a processor.

Solvability and Performance:

- Examine the factors that affect the decidability of a problem.
- Identify which problems can and cannot always be solved by an algorithm.
- Compare and evaluate equivalent algorithms for relative efficiency.

Coding Skills:

- Identify the needs and applications of cryptography in our digital world.
- Examine the mathematical basis of cryptography.
- Encode and decode messages using common cryptographic techniques.

Global Impact:

- Investigate common threats to cybersecurity, and identify the needs for robust cybersecurity.
- Analyze the function and effectiveness of common cybersecurity and classify its components.
- E

New Jersey Student Learning Standards (NJSLS-S)

CSTA Standards

Computational Thinking

- CT.L3A-07: Describe how various types of data are stored in a computer system
- CT.L3B-05: Use data analysis to enhance understanding of complex natural and human systems.

Collaboration

- CL.L3A-02: Use collaborative tools to communicate with project team members (e.g. discussion threads, wikis, blogs, version control, etc.).
- CL.L3B-01: Use project collaboration tools, version control systems, and Integrated Development Environments (IDEs) while working on a collaborative software project.
- CL.L3B-03: Evaluate programs written by others for readability and usability.

Computing Practice and Programming

- CPP.L3A-03: Use various debugging and testing methods to ensure program correctness (e.g., use one or more software lifecycle models).
- CPP.L3A-04: Apply analysis, design, and implementation techniques to solve problems (e.g., use one or more software lifecycle models).
- CPP.L3A-05: Use Application Program Interfaces (APIs) and libraries to facilitate programming solutions.
- CPP.L3A-06: Select appropriate file formats for various types and uses of data.
- CPP.L3A-08: Explain the program execution process.
- CPP.L3B-01: Use advanced tools to create digital artifacts (e.g., web design, animation, video, multimedia).
- CPP.L3B-08: Deploy various data collection techniqes for different types of problems.

Computers and Communication Devices

- CD.L3A-01: Describe the unique features of computers embedded in mobile devices and vehicles (e.g., cell phones, automobiles, airplanes).
- CD.L3A-02: Develop criteria for purchasing or upgrading computer system hardware.
- CD.L3A-03: Describe the principal components of computer organization (e.g., input, output, processing, and storage).
- CD.L3A-04: Compare various forms of input and output.
- CD.L3A-05: Explain the multiple levels of hardware and software that support program execution (e.g. compilers, interpreters, operating systems, networks).
- CD.L3A-06: Apply strategies for identifying and solving routine hardware and software problems that occur in everyday life.
- CD.L3A-07: Compare and contrast client-server and peer-to-peer network strategies.
- CD.L3A-08: Explain the basic components of computer networks (e.g., servers, file protection, routing, spoolers and queues, shared resources, and fault-tolerance)
- CD.L3B-04: Describe the issues that impact network functionality (e.g., latency, bandwidth, firewalls, server capability).

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.8.2.12.C.4	Explain and identify interdependent systems and their functions.
TECH.8.2.12.C.7	Use a design process to devise a technological product or system that addresses a global problem, provide research, identify trade-offs and constraints, and document the process through drawings that include data and materials.
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.
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).

Interdisciplinary Connections

Mathematics Math Practices.1 Make sense of problems and persevere in solving them. Math Practices.2 Reason abstractly and quantitatively. Math Practices.3 Construct viable arguments and critique the reasoning of others. Math Practices.4 Model with mathematics. Math Practices.5 Use appropriate tools strategically. Math Practices.6 Attend to precision. Math Practices.7 Look for and make use of structure. Math Practices.8 Look for and express regularity in repeated reasoning.

Social Studies 6.3.12.D.1 Analyze the impact of current governmental practices and laws affecting national security and/or individual civil rights/ privacy

Visual and Performing Arts 1.1.12.D.2 Translate literary, musical, theatrical, and dance compositions by using them as stimulus/inspiration for corresponding visual artworks.

English Language Arts NJSLSA.R4 Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone. NJSLSA.R7 Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words. RI.11-12.4 Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze how an author uses and refines the meaning of a key term or terms over the course of a text (e.g., how Madison defines faction in Federalist No. 10). RI.11-12.7 Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem. NJSLSA.W4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. NJSLSA.W6 Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others. NJSLSA.W10 Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences. W.11-12.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. (Grade-specific expectations for writing types are defined in standards 1–3 above.) W.11-12.6 Use technology, including the Internet, to produce, share, and update individual or shared writing products in response to ongoing feedback, including new arguments or information. W.11-12.10 Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes

LA.RH.11-12.7	Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, qualitatively, as well as in words) in order to address a question or solve a problem.
LA.RST.11-12.3	Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
LA.RST.11-12.4	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-

	12 texts and topics.
LA.RST.11-12.7	Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.
LA.RST.11-12.8	Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.
LA.RST.11-12.9	Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.
LA.WHST.11-12.1.A	Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.
LA.WHST.6-8.10	Write routinely over extended time frames (time for research, reflection, metacognition/self correction, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

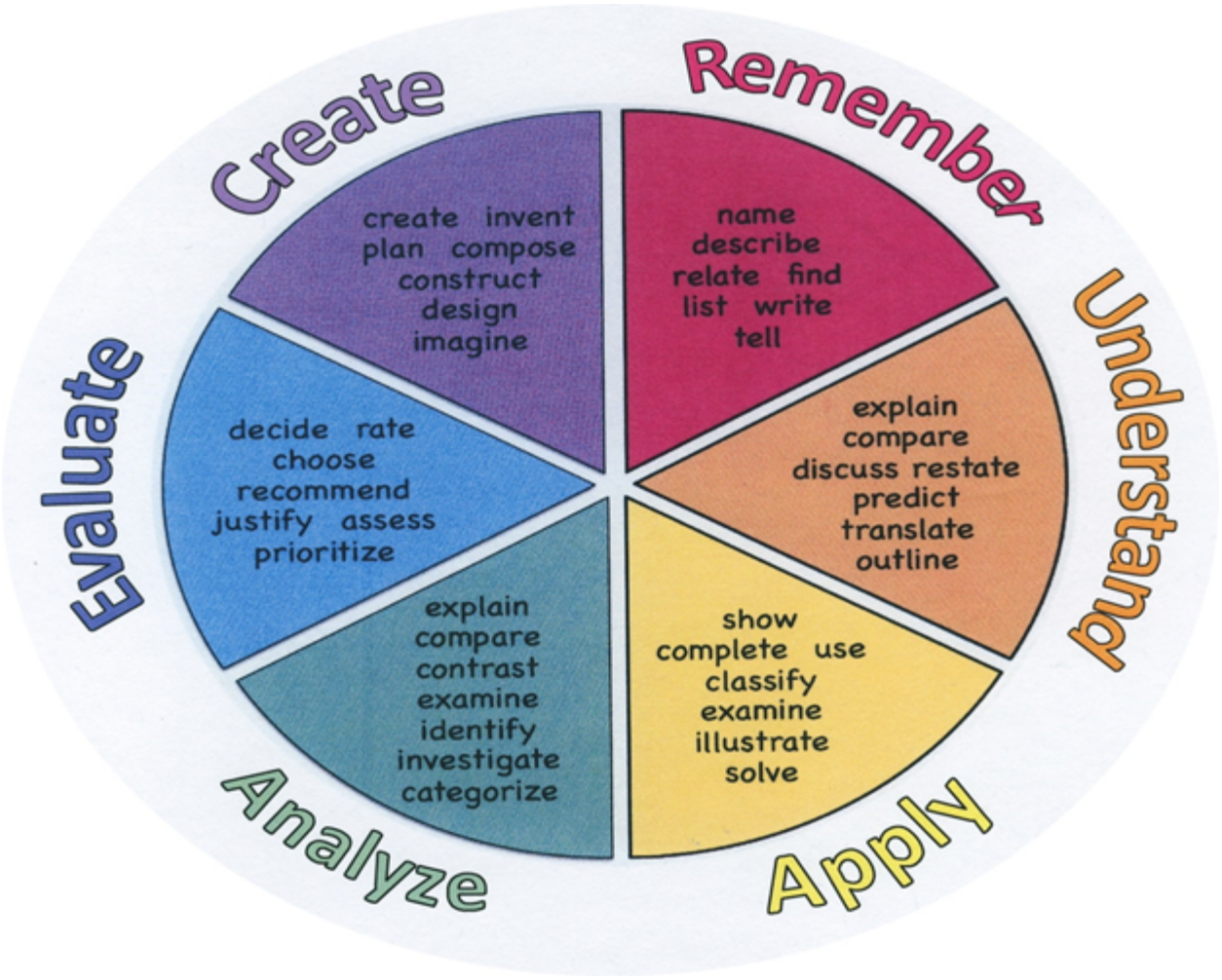
Learning Objectives

Why do we need algorithms?

- How is designing an algorithm to solve a problem different from other kinds of problem solving?
- How do you design a solution for a problem so that it is programmable?

- Explain the global effect of computing -- both beneficial and harmful -- on people and society.
- Recognize how computing enhances communication, interaction, and cognition.
- Understand how Computing enables innovation in nearly every field.
- Describe the positive and negative impacts a computer innovation has had on the world.
- How do computer represent information?
- How does information get from one computer to another?
- Define the challenges involved when developing systems to represent or transmit information?
- Communicate the computing innovation has had the most significant personal impact on your life?
- Explain what life / the world be like without computers?
- Give a detailed description of who or what is “in charge” of the internet?

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

- 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

Assessment Evidence - Checking for Understanding (CFU)

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

Web-based assessment-**Alternate assessment**

Flash Talk: students will prepare a talk on Net Neutrality, Internet Censorship, or Computer/Network Surveillance-**Benchmark assessment**

- 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

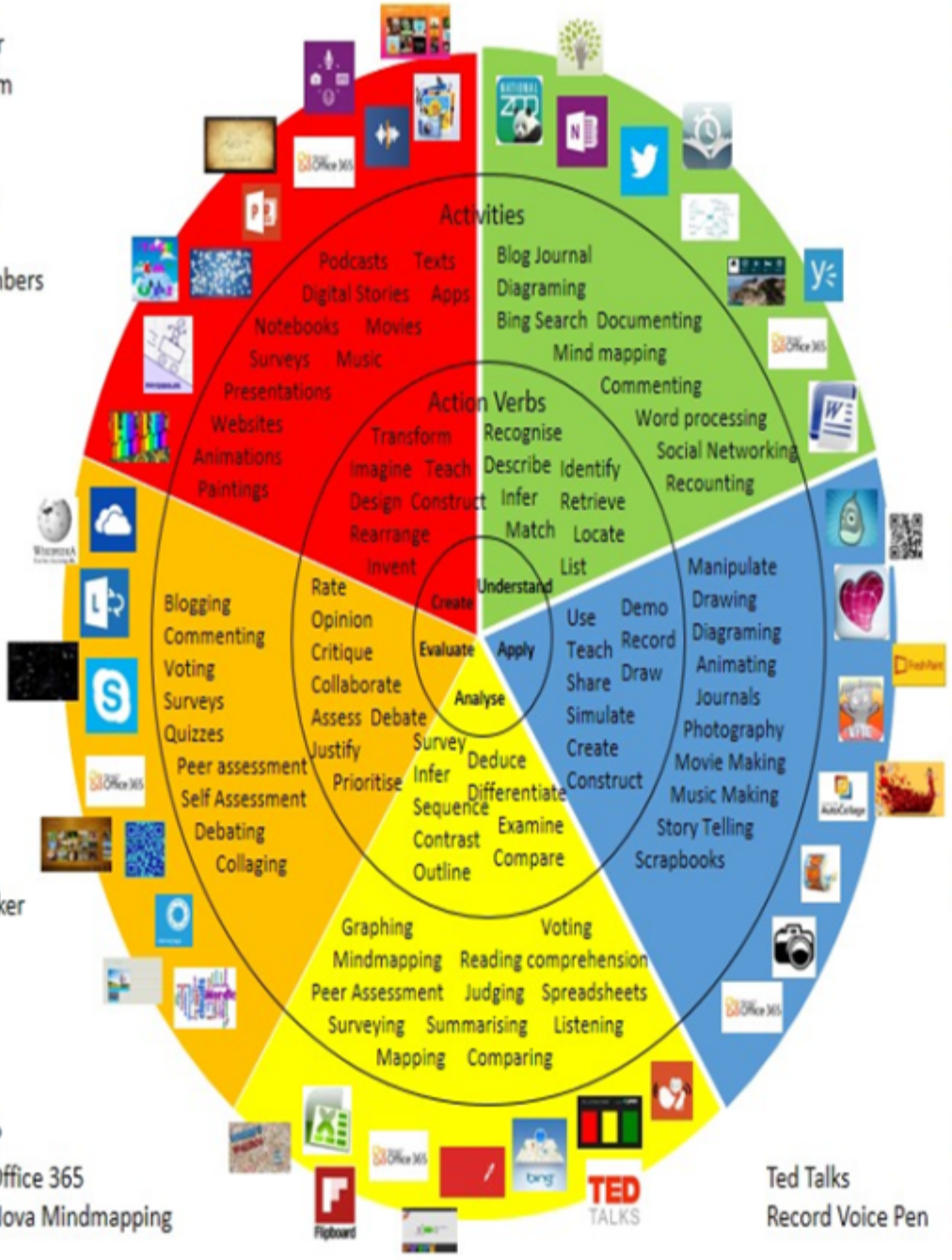
Please reference video links and websites listed under Ancillary Resources and Suggested Activities & Best Practices.

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.

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.

CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
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.
CRP.K-12.CRP5	Consider the environmental, social and economic impacts of decisions.
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.
CRP.K-12.CRP6	Demonstrate creativity and innovation.
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.
CRP.K-12.CRP7	Employ valid and reliable research strategies.
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.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.K-12.CRP11	Use technology to enhance productivity.
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.

21st Century Skills/Interdisciplinary Themes

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

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.1	Create a personal digital portfolio which reflects personal and academic interests, achievements, and career aspirations by using a variety of digital tools and resources.

TECH.8.1.12.A.CS1	Understand and use technology systems.
TECH.8.1.12.A.CS2	Select and use applications effectively and productively.

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

One technique I use is when I teach a new Computer Science skill.
For example, let's say we are working with Scratch and I note that there is a student that knows more code beyond the 'basic' lesson I presented. That is a student that is already ready for a more difficult challenge. Now if you teach multiple grade levels (as I do) sometimes I just ask the student if they would like to try a challenge that I'm giving the next grade using the same tool.

Another technique I've used is having 'task cards' on hand. For example, if we are doing a lesson on loops and there is clearly a pair of students in the class that has mastered the skill, I then have task cards with challenges ready on different skills or a harder looping concept.

I've also used task cards in another way. I've printed twelve task cards and told the students they could move on once they have mastered one card. I've made it clear that some students would get further then other in the

course of one period and that I was ok with that. Stressing the non-competition part is important when trying to use this differentiation technique because otherwise they just try to get through as many cards as possible without actually understanding what they are doing.

Differentiations Include:

- 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.

Other:

Alternate Responses

When assessing your ESL students, be sure that you're clear on exactly what it is that you want them to demonstrate. Then, think of creative ways that they can demonstrate that knowledge. For instance, a teacher assessing students'

understanding of causes of the Revolutionary War may traditionally have required that students write responses to a number of questions or prompts. For ELLs, this may be restrictive and prevent them from communicating what they actually know.

- 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