Unit 6: Innovative Technologies

Content Area: **Technology**
Course(s): **Sample Course**
Time Period: **AprMay**
Length: **Full Year 9-12**
Status: **Published**

Unit Overview

Explore the current state of technology and its role in our everyday lives.

Enduring Understanding

- Characteristics of the Internet influence the systems built on it.
- Models and simulations are simplified representations of more complex objects or phenomena that use abstraction to generate new understanding and knowledge.
- Computing innovations influence and are influenced by the economic, social, and cultural contexts in which they are designed and used.

Essential Questions

- Has the Internet's design and development helped it to scale and flourish?
- Is cyber security impacting the ever-increasing number of Internet users?
- Do economic, social, and cultural contexts influence innovation and the use of computing?

Exit Skills

- Assess the benefits and risks of cloud computing.
- Assess the benefits and risks of open versus closed platforms.
- Investigate the socioeconomic causes and effects related to the digital divide.
- Explore concepts and characteristics as follows: the role of servers, routers, gateways, and clients; the domain name system and its role in network routing; standard network protocols; the components and

events involved in the transmission of an email or SMS text over the network; and the components and events involved in the transmission of an HTML request from a Web browser.
- Analyze the impact of hyperlinked documents on how individuals find, acquire, and learn new information.
- Assess the legal, social, and commercial impact that the World Wide Web has had on society.
- Predict how individuals' lives may be enhanced through technological innovations.
- Develop design specifications for hypothetical, future technology.

New Jersey Student Learning Standards (NJSLS-S)

CS.9-12.8.1.12.CS.1	Describe ways in which integrated systems hide underlying implementation details to simplify user experiences.
CS.9-12.8.1.12.CS.2	Model interactions between application software, system software, and hardware.
CS.9-12.8.1.12.CS.3	Compare the functions of application software, system software, and hardware.
CS.9-12.8.1.12.NI.1	Evaluate the scalability and reliability of networks, by describing the relationship between routers, switches, servers, topology, and addressing.
CS.9-12.CS	Computing Systems
CS.9-12.NI	Networks and the Internet
TECH.9.4.12.CI	Creativity and Innovation
TECH.9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
TECH.9.4.12.CI.2	Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8).
TECH.9.4.12.CI.3	Investigate new challenges and opportunities for personal growth, advancement, and transition (e.g., 2.1.12.PGD.1).
TECH.9.4.12.CT	Critical Thinking and Problem-solving
TECH.9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).
TECH.9.4.12.CT.2	Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).
TECH.9.4.12.CT.3	Enlist input from a variety of stakeholders (e.g., community members, experts in the field) to design a service learning activity that addresses a local or global issue (e.g.,

	environmental justice).
TECH.9.4.12.CT.4	Participate in online strategy and planning sessions for course-based, school-based, or other project and determine the strategies that contribute to effective outcomes.
	Innovative ideas or innovation can lead to career opportunities.
	The scalability and reliability of the Internet are enabled by the hierarchy and redundancy in networks. Network topology is determined by many characteristics.
	With a growth mindset, failure is an important part of success.
	A computing system involves interaction among the user, hardware, application software, and system software.
	The usability, dependability, security, and accessibility of devices within integrated systems are important considerations in their design as they evolve.

Interdisciplinary Connections

LA.RL.11-12	Reading Literature
	Key Ideas and Details
LA.RL.11-12.1	Cite strong and thorough textual evidence and make relevant connections to support analysis of what the text says explicitly as well as inferences drawn from the text, including determining where the text leaves matters uncertain.
LA.RL.11-12.2	Determine two or more themes or central ideas of a text and analyze their development over the course of the text, including how they interact and build on one another to produce a complex account; provide an objective summary of the text.
LA.RL.11-12.3	Analyze the impact of the author's choices regarding how to develop and relate elements of a story or drama (e.g., where a story is set, how the action is ordered, how the characters are introduced and developed).
	Craft and Structure
LA.L.11-12.4	Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grades 11–12 reading and content, choosing flexibly from a range of strategies.
LA.L.11-12.4.A	Use context (e.g., the overall meaning of a sentence, paragraph, or text; a word's position or function in a sentence) as a clue to the meaning of a word or phrase.
LA.L.11-12.4.B	Identify and correctly use patterns of word changes that indicate different meanings or parts of speech (e.g., conceive, conception, conceivable).
LA.L.11-12.4.C	Consult general and specialized reference materials (e.g., dictionaries, glossaries, thesauruses), both print and digital, to find the pronunciation of a word or determine or clarify its precise meaning, its part of speech, its etymology, or its standard usage.
LA.L.11-12.4.D	Verify the preliminary determination of the meaning of a word or phrase (e.g., by checking the inferred meaning in context or in a dictionary).

Learning Objectives

Everyday Computing:

- Explore the ways that innovations in digital technology can impact the lives of individuals and communities.
- Analyze the role that digital technology plays in their social communications and interactions.
- Explore the impact that instant access to global search, news, and information has had on individuals and communities.
- Assess the benefits and risks of cloud computing.
- Assess the benefits and risks of open versus closed platforms.
- Investigate the socioeconomic causes and effects related to the digital divide.

The Internet:

- Examine the overall design and architecture of the Internet.
- Explore concepts and characteristics as follows: the role of servers, routers, gateways, and clients; the domain name system and its role in network routing; standard network protocols; the components and events involved in the transmission of an email or SMS text over the network; and the components and events involved in the transmission of an HTML request from a Web browser.
- Analyze the impact of hyperlinked documents on how individuals find, acquire, and learn new information.
- Assess the legal, social, and commercial impact that the World Wide Web has had on society.

Innovations in Computing:

- Investigate a number of key individuals and breakthroughs in the development of modern computing.
- Analyze and extrapolate from recent advances in computing to make predictions about the capabilities of future technologies.
- Predict how future technologies might impact individuals and societies.

Coding Skills:

Identify shortcomings of existing technologies.

- Predict how individuals' lives may be enhanced through technological innovations.
- Develop design specifications for hypothetical, future technologies.

Suggested Activities & Best Practices

- Explore the ways that innovations in digital technology can impact the lives of individuals and communities.
- Analyze the role that digital technology plays in their social communications and interactions.
- Examine the overall design and architecture of the Internet.
- Explore concepts and characteristics as follows: the role of servers, routers, gateways, and clients; the domain name system and its role in network routing; standard network protocols; the components and events involved in the transmission of an email or SMS text over the network; and the components and events involved in the transmission of an HTML request from a Web browser.
- Investigate a number of key individuals and breakthroughs in the development of modern computing.
- Analyze and extrapolate from recent advances in computing to make predictions about the capabilities of future technologies.
- Identify shortcomings of existing technologies.
- Predict how individuals' lives may be enhanced through technological innovations.
- Student will be able to identify famous African Americans in the field of computer programming

- Students will also be introduced to the basic energy efficient models in the programming field to help reduce global warming

Assessment Evidence - Checking for Understanding (CFU)

• Think, pair, share review questions from text.-formative assessment

Unit test-summative assessment

Multimedia reports-alternate assessment

• Practice mini-programs to strengthen concepts as taught.

• Teacher Observation

-benchmark assesments

- Analyze and extrapolate from recent advances in computing to make predictions about the capabilities of future technologies.
- Identify shortcomings of existing technologies.
- Predict how individuals' lives may be enhanced through technological innovations.

- 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

Edhesive Online Computer Simulation, Code.Org.

Ancillary Resources

General Resources:

- 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.

AP Approved Programming Resources:

(may choose one or more)

- 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:

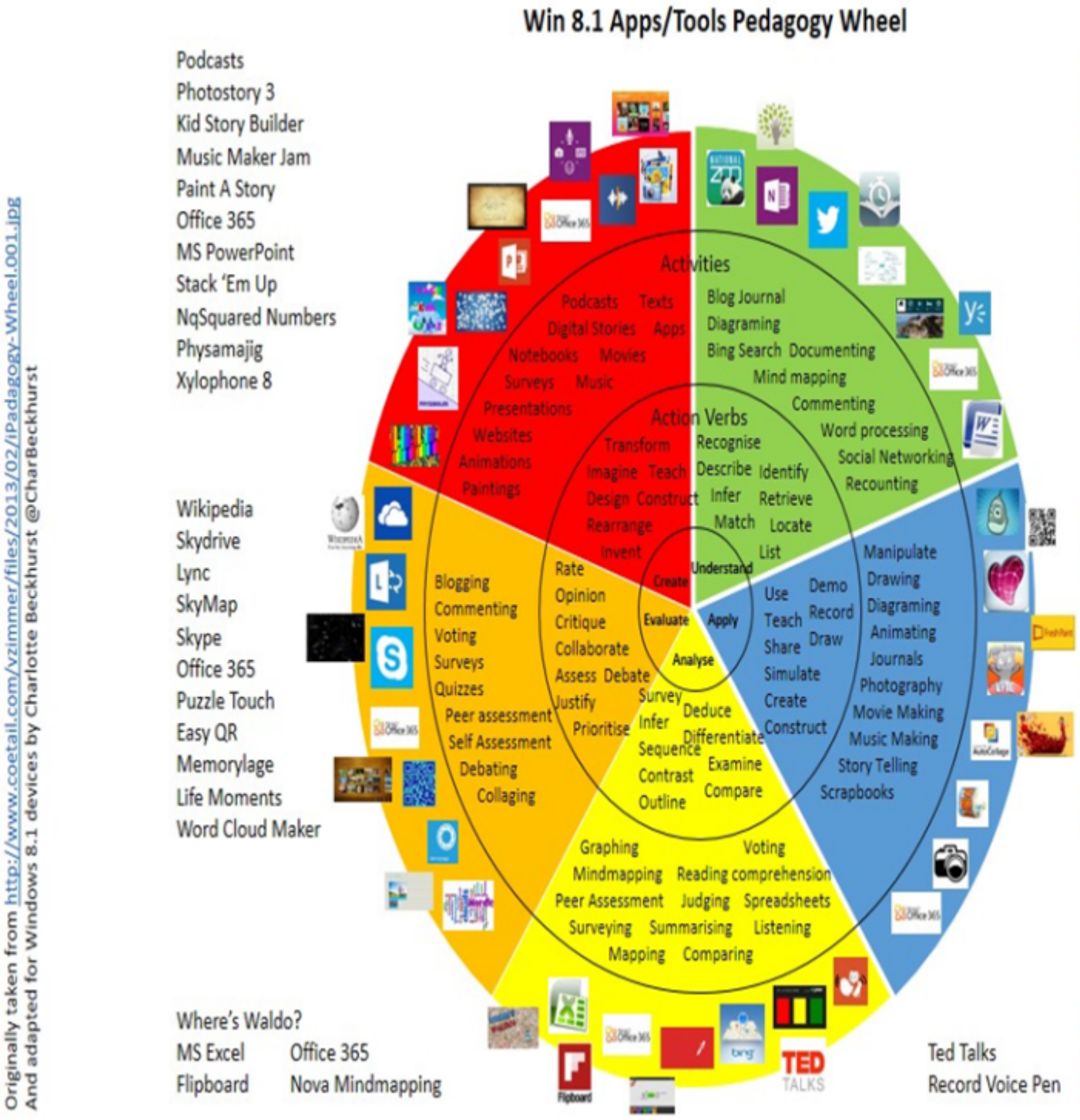
- "What Is Open Source?" Opensource.com. https://opensource.com/resources/whatopen-source
- Open Source Initiative. http://opensource.org/

Technology Infusion

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

Practices.

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



Alignment to 21st Century Skills & Technology

WRK.9.2.12.CAP	Career Awareness and Planning
WRK.9.2.12.CAP.1	Analyze unemployment rates for workers with different levels of education and how the economic, social, and political conditions of a time period are affected by a recession.
WRK.9.2.12.CAP.2	Develop college and career readiness skills by participating in opportunities such as structured learning experiences, apprenticeships, and dual enrollment programs.
WRK.9.2.12.CAP.3	Investigate how continuing education contributes to one's career and personal growth.
WRK.9.2.12.CAP.4	Evaluate different careers and develop various plans (e.g., costs of public, private, training schools) and timetables for achieving them, including educational/training requirements, costs, loans, and debt repayment.
TECH.9.4.12.CI	Creativity and Innovation
TECH.9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
TECH.9.4.12.CI.2	Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8).
TECH.9.4.12.CI.3	Investigate new challenges and opportunities for personal growth, advancement, and transition (e.g., 2.1.12.PGD.1).
TECH.9.4.12.CT	Critical Thinking and Problem-solving
TECH.9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).
TECH.9.4.12.CT.2	Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).
TECH.9.4.12.CT.3	Enlist input from a variety of stakeholders (e.g., community members, experts in the field) to design a service learning activity that addresses a local or global issue (e.g., environmental justice).
	There are strategies to improve one’s professional value and marketability.
	Career planning requires purposeful planning based on research, self-knowledge, and informed choices.
	With a growth mindset, failure is an important part of success.
	Innovative ideas or innovation can lead to career opportunities.

21st Century Skills/Interdisciplinary Themes

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.

- 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

LA.RH.6-8.7	Integrate visual information (e.g., in charts, graphs, photographs, videos, or maps) with other information in print and digital texts.
LA.RH.6-8.8	Distinguish among fact, opinion, and reasoned judgment in a text.

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

CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP10.1	Career-ready individuals take personal ownership of their own education and career goals, and they regularly act on a plan to attain these goals. They understand their own career interests, preferences, goals, and requirements. They have perspective regarding the pathways available to them and the time, effort, experience and other requirements to pursue each, including a path of entrepreneurship. They recognize the value of each step in the education and experiential process, and they recognize that nearly all career paths require ongoing education and experience. They seek counselors, mentors, and other experts to assist in the planning and execution of career and personal goals.
CRP.K-12.CRP11	Use technology to enhance productivity.
CRP.K-12.CRP12	Work productively in teams while using cultural global competence.

CRP.K-12.CRP12.1	Career-ready individuals positively contribute to every team, whether formal or informal. They apply an awareness of cultural difference to avoid barriers to productive and positive interaction. They find ways to increase the engagement and contribution of all team members. They plan and facilitate effective team meetings.

Differentiation

Exemplars -

Differentiation

Meeting with small groups to re-teach an idea or skill for struggling learners, or to extend the thinking or skills of advanced learners.

. Varying the length of time a student may take to complete a task in order to provide additional support for a struggling learner or to encourage an advanced learner to pursue a topic in greater depth.

Using rubrics that match and extend students' varied skills levels;

Helping students understand that some learners need to move around to learn, while others do better sitting quietly (Tomlinson, 1995, 1999; Winebrenner, 1992, 1996).

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)

Adapting existing materials, simplifying or supplementing materials for Special Education Learning other options are below.

Exemplars:

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

- IEP:

1. Adherence to the students' Individualized Learning Plan.

2. Students will have extra time or fewer assignments, one-to-one assistance, and group work will often be enlisted.

3. Students may use speech-to-text or audio/video record assignments

4. Teacher may adapt learning style to fit the needs of the child.

5. Teacher will use graphic organizer to visually help students plan out their work.

6. The teacher will scaffold the lesson with a slow release from assisted support with guided practice to independent practice.

7. Front-loaded notes to enable students to more accurately follow along with teacher's instruction.

8. Step-by-step directions written out for students.

504:

1. Any necessary accommodations will be made as outlined in students' 504 plan.

2. Preferential seating while teacher is lecturing, explaining, etc.

3. Extended time on projects or assessments.

4. Verbal, visual or technology aids.

- 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)

Exemplars : Advance Notes

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

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

- using computer word processing spell check and grammar check features
- using true/false, matching, or fill in the blank tests in lieu of essay tests

At Risk

Exemplars :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.

- 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

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

Provide students with problem-based learning activity using multiple standards from 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

Lesson Plan – Global Impacts of Computing - Innovative Technologies

Teacher:	Corey Woodring	Time Frame:	13 days
Grade:	9-12	School:	Belleville High School
Subject:	AP Computer Science Principles		

AP Essential Knowledge

(Referenced from CollegeBoard AP CS P Course & Exam Description)

IOC-1 While computing innovations are typically designed to achieve a specific purpose, they may have unintended consequences.

A. Explain how an effect of a computing innovation can be both beneficial and harmful.

1. People create computing innovations.
2. The way people complete tasks often change to incorporate new computing innovations.
3. Not every effect of a computing innovation is anticipated in advance.
4. A single effect can be viewed as both beneficial and harmful by different people, or even by the same person.
5. Advances in computing have generated and increased creativity in other fields, such as medicine, engineering, communications, and the arts.

A. Explain how a computing innovation can have an impact beyond its intended purpose.

1. Computing innovations can be used in ways that their creators had not originally intended:

- The World Wide Web was originally intended only for rapid and easy exchange of information within the scientific community.
- Targeted advertising is used to help businesses, but it can be misused at both individual and aggregate levels.
- Machine learning and data mining have enabled innovation in medicine, business, and science, but information discovered in this way has also been used to discriminate against groups of individuals.

1. Some of the ways computing innovations can be used may have a harmful impact on society, the economy, or culture.
2. Responsible programmers try to consider the unintended ways their computing innovations can be used and the potential beneficial and harmful effects of these new uses.
3. It is not possible for a programmer to consider all the ways a computing innovation can be used.
4. Computing innovations have often had unintended beneficial effects by leading to advances in other fields.
5. Rapid sharing of a program or running a program with a large number of users can result in significant impacts beyond the intended purpose or control of the programmer.

A. Describe issues that contribute to the digital divide.

1. Internet access varies between socioeconomic, geographic, and demographic characteristics, as well as between countries.
2. The “digital divide” refers to differing access to computing devices and the Internet, based on socioeconomic, geographic, or demographic characteristics.
3. The digital divide can affect both groups and individuals.
4. The digital divide raises issues of equity, access, and influence, both globally and locally.
5. The digital divide is affected by the actions of individuals, organizations, and governments.

A. Explain how bias exists in computing innovations.

1. Computing innovations can reflect existing human biases because of biases written into the algorithms or biases in the data used by the innovation.
2. Programmers should take action to reduce bias in algorithms used for computing innovations as a way of combating existing human biases.
3. Biases can be embedded at all levels of software development.

A. Explain how people participate in problem solving processes at scale.

1. Widespread access to information and public data facilitates the identification of problems,

development of solutions, and dissemination of results.

2. Science has been affected by using distributed and "citizen science" to solve scientific problems.

3. Citizen science is scientific research conducted in whole or part by distributed individuals, many of whom may not be scientists, who contribute relevant data to research using their own computing devices.

4. Crowdsourcing is the practice of obtaining input or information from a large number of people via the Internet.

5. Human capabilities can be enhanced by collaboration via computing.

6. Crowdsourcing offers new models for collaboration, such as connecting businesses or social causes with funding

A. Explain how the use of computing can raise legal and ethical concerns.

1. Material created on a computer is the intellectual property of the creator or an organization.

2. Ease of access and distribution of digitized information raises intellectual property concerns regarding ownership, value, and use.

3. Measures should be taken to safeguard intellectual property.

4. The use of material created by someone else without permission and presented as one's own is plagiarism and may have legal consequences.

5. Some examples of legal ways to use materials created by someone else include:

- Creative Commons—a public copyright license that enables the free distribution of an otherwise copyrighted work. This is used when the content creator wants to give others the right to share, use, and build upon the work they have created.

- open source—programs that are made freely available and may be redistributed and modified

- open access—online research output free of any and all restrictions on access and free of many restrictions on use, such as copyright or license restrictions

1. The use of material created by someone other than you should always be cited.

2. Creative Commons, open source, and open access have enabled broad access to digital information.

3. As with any technology or medium, using computing to harm individuals or groups of people raises legal and ethical concerns.

4. Computing can play a role in social and political issues, which in turn often raises legal and ethical concerns.

5. The digital divide raises ethical concerns around computing.

6. Computing innovations can raise legal and ethical concerns. Some examples of these include:

- the development of software that allows access to digital media downloads and streaming
- the development of algorithms that include bias
- the existence of computing devices that collect and analyze data by continuously monitoring activities

IOC-2 The use of computing innovations may involve risks to personal safety and identity.

A. Describe the risks to privacy from collecting and storing personal data on a computer system.

1. Personally identifiable information (PII) is information about an individual that identifies, links, relates, or describes them. Examples of PII include:

- Social Security number
- Age
- Race
- phone number(s)
- medical information
- financial information
- biometric data

1. Search engines can record and maintain a history of searches made by users.
2. Websites can record and maintain a history of individuals who have viewed their pages.
3. Devices, websites, and networks can collect information about a user's location.
4. Technology enables the collection, use, and exploitation of information about, by, and for individuals, groups, and institutions.
5. Search engines can use search history to suggest websites or for targeted marketing.
6. Disparate personal data, such as geolocation, cookies, and browsing history, can be aggregated to create knowledge about an individual.
7. PII and other information placed online can be used to enhance a user's online experiences.
8. PII stored online can be used to simplify making online purchases.
9. Commercial and governmental curation of information may be exploited if privacy and other protections are ignored.
10. Information placed online can be used in ways that were not intended and that may have a harmful impact. For example, an email message may be forwarded, tweets can be retweeted, and social media posts can be viewed by potential employers.
11. PII can be used to stalk or steal the identity of a person or to aid in the planning of other criminal acts.

12. Once information is placed online, it is difficult to delete.

13. Programs can collect your location and record where you have been, how you got there, and how long you were at a given location.

14. Information posted to social media services can be used by others. Combining information posted on social media and other sources can be used to deduce private information about you.

CRD – 1

A. Explain how computing innovations are improved through collaboration

    1. A computing innovation includes a program as an integral part of its function.

    2. A computing innovation can be physical (e.g. self-driving car), nonphysical computing software (e.g. picture editing software), or a nonphysical computing concept (e,g. e-commerce).

    3. Effective collaboration produces a computing innovation that reflects the diversity of talents and perspectives of those who designed it.

    4. Collaboration that includes diverse perspectives helps avoid bias in the development of computing innovations.

    5. Consultation and communication with users are important aspects of the development computing innovations.

    6. Information gathered from potential users can be used to understand the purpose of a program from diverse perspectives and to develop a program that fully incorporates these perspectives.

B. Explain how computing innovations are developed by groups of people.

    1. Online tools support collaboration by allowing programmers to share and provide feedback on ideas and documents.

    2. Common models such as pair programming exist to facilitate collaboration.

C. Demonstrate effective interpersonal skills during collaboration.

    1. Effective collaborative teams practice interpersonal skills, including gbut not limited to:

        i. Communication

        ii. Consensus building

        iii. Conflict resolution

        iv. negotiation

CRD – 2

A. Describe the purpose of a computing innovation

    1. The purpose of computing innovations is to solve problems or to pursue interests through

creative expression.

2. An understanding of the purpose of a computing innovation provides developers with an improved ability to develop that computing innovation.

B. Explain how a program or code segment functions.

1. A program is a collection of program statements that performs a specific task when run by a computer. A program is often referred to as software.

2. A code segment is a collection of program statements that is part of a program.

3. A program needs to work for a variety of inputs and situations.

4. The behavior of a program is how a program functions during execution and is often described by how a user interacts with it.

5. A program can be described broadly by what it does or in more detail by both what the program does and how the program statements accomplish this function.

C. Identify input(s) to a program

1. Program inputs are data sent to a computer for processing by a program. Input can come in a variety of forms, such as tactile, audio, visual, or text

2. An event is associated with an action and supplies input data to a program.

3. Events can be generated when a key is pressed, a mouse is clicked, a program is started, or any other defined action occurs that affects the flow of execution.

4. Inputs usually affect the output produced by a program.

5. In event-driven programming, program statements are executed when triggered rathe rthan through the sequential flow of control.

6. Input can come from a user or other programs.

D. Identify output(s) produced by a program.

1. Program outputs are any data sent from a program to a device. Program output can come in a variety of forms, such as tactile, audio, visual, or text.

2. Program output is usually based on a program's input or prior state (e.g. internal values).

E. Develop a program using a development process.

1. A development process can be ordered and intentional, or exploratory in nature.

2. There are multiple development processes. The following phases are commonly used when developing a program:

    i. Investigating and reflecting

ii. Designing

iii. Prototyping

iv. Testing

3. A development process that is iterative requires refinement and revision based on feedback, testing, or reflection throughout the process. This may require revisiting earlier phases of the process.

4. A development process that is incremental is one that breaks the problem into smaller pieces and makes sure each piece works before adding it to the whole.

Enduring Understanding & CTP Skills

(Referenced from CollegeBoard AP CS P Course & Exam Description)

AAP-2 The way statements are sequenced and combined in a program determines the computed result. Programs incorporate iteration and selection constructs to represent repetition and make decisions to handle varied input values.

1. Computing Innovations

A. Explain how computing systems work.

C. Describe the impact of a computing innovation.

E. Evaluate the use of computing based on legal and ethical factors.

1. Responsible Computing

A. Collaborate in the development of solutions.

B. Use safe and secure methods when using computing devices.

C. Acknowledge the intellectual property of others.

Essential Questions

(Some referenced from CollegeBoard AP CS P Course & Exam Description)

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

1. How have the various industries evolved with the improvement of computing?

2. How has the continuously evolving technology industry positively impacted society?

3. How has the continuously evolving technology industry negatively impacted society?
4. What are the legal and ethical responsibilities of a citizen in a digital world?

Assessment

(What is acceptable evidence to show desired results (rubrics, exam, etc.)? Attach Copy

- Complete various written checkpoint exercises that focus on the explanation and description of computer programming, pseudocode, and python.
- Develop a visual representation of the communication processes within a computer using appropriate terminology.
- 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.
- Unit 3 Assessment

Formative Evaluations:

Formative Assessment with polling

Classwork/Homework

Quizzes

AP Classroom Big Idea 5 Formative Topic Questions (see Sequence and Scope for when to assign problems)

Lab work

Summative Evaluations:

Unit 6 Test/ReTest

Sequence and Scope

Day	Topic/Activities	CW-HW
1	• Computing Has Changed Our World	Article 1
2	• Finish: Computing Has Changed Our World	AP Classroom Topic Questions 5.1
3	• Benefits of Computing	Start Article 2
4	• Complete Article 2 Research Questions and Quiz questions 1-3	
5	• Downfalls of Computing	Article 3
6	• Articles 4 and 5 (or choose 1) and Quiz question 4	

7	• Legal & Ethical Implications of Computing	Article 6
8	• Article 7	AP Classroom Topic Questions 5.2 – 5.5
9	• Create Task Presentation	
10	• Lab	
11	• Lab	Study for Test
13	• Unit 6 Assessment	None

Student Assessment/CFU's:

Materials:

21st Century Themes and Skills:

Differentiation/Modifications:

Integration of Technology:

CS.9-12.8.1.12.CS.1	Describe ways in which integrated systems hide underlying implementation details to simplify user experiences.
CS.9-12.8.1.12.CS.2	Model interactions between application software, system software, and hardware.
CS.9-12.8.1.12.CS.3	Compare the functions of application software, system software, and hardware.
CS.9-12.8.1.12.CS.4	Develop guidelines that convey systematic troubleshooting strategies that others can use to identify and fix errors.
CS.9-12.CS	Computing Systems
CS.9-12.NI	Networks and the Internet
TECH.9.4.12.CI	Creativity and Innovation
TECH.9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
TECH.9.4.12.CI.2	Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8).
TECH.9.4.12.CI.3	Investigate new challenges and opportunities for personal growth, advancement, and transition (e.g., 2.1.12.PGD.1).
	The usability, dependability, security, and accessibility of devices within integrated systems are important considerations in their design as they evolve.
	A computing system involves interaction among the user, hardware, application

software, and system software.

With a growth mindset, failure is an important part of success.

Innovative ideas or innovation can lead to career opportunities.