

Unit 6: Innovative Technologies

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Computer Science Principles

Department of Curriculum and Instruction



Belleville Public Schools

Curriculum Guide

Computer Science Principles, Grades 9-12

Innovative Technologies

Belleville Board of Education

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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)

8.1 Educational Technology

8.1.12.A.4, 8.1.12.C.1, 8.1.12.D.2, 8.1.12.F.2,

8.2 Technology, Engineering, Design and Computational Thinking

8.2.12.B.1, 8.2.12.B.2, 8.2.12.E.1, 8.2.12.E.2, 8.2.12.E.3, 8.2.12.E.4

TECH.8.1.12.F.CS3	Collect and analyze data to identify solutions and/or make informed decisions.
TECH.8.1.12	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.B	Students demonstrate creative thinking, construct knowledge and develop innovative products and process using technology.
TECH.8.1.12.F	Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.
TECH.8.2.12	All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.
TECH.8.1.12.D.CS2	Demonstrate personal responsibility for lifelong learning.
TECH.8.1.12.A.CS2	Select and use applications effectively and productively.
TECH.8.1.12.D.1	Demonstrate appropriate application of copyright, fair use and/or Creative Commons to an original work.

Interdisciplinary Connections

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

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.

Evidence of Student Learning - Checking for Understanding (CFU)

Evidence of Student Learning with Checking for Understanding (CFU) techniques used during the lesson and/or for Closure (Madeline Hunter), listed are the variety of means used to assess students' learning.

- Admit Tickets
- Anticipation Guide
- Common benchmarks
- Compare & Contrast
- Create a Multimedia Poster
- Define
- Describe
- Evaluate
- Evaluation rubrics
- Exit Tickets
- Explaining
- Fist- to-Five or Thumb-Ometer
- Illustration
- Journals
- KWL Chart
- Newspaper Headline
- Outline
- Question Stems
- Quickwrite
- Quizzes
- Red Light, Green Light

- Self- assessments
- Socratic Seminar
- Study Guide
- Teacher Observation Checklist
- Think, Pair, Share
- Think, Write, Pair, Share
- Top 10 List
- Unit tests

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](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

Technology Infusion and/or strategies are integrated into this unit to enhance learning many will be implemented below:

Win 8.1 Apps/Tools Pedagogy Wheel



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

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

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

21st Century Skills that will be incorporated in this unit:

- Civic Literacy
- Environmental Literacy

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

Differentiation

Differentiation 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

Intervention Strategies

Intervention Strategies that will be employed in the unit, 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 work presented 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

Special Education Learning

Special Education Learning adaptations that will be employed in the unit, 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
- 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)

English Language Learning adaptations that will be employed in the unit:

- teaching key aspects of a topic. Eliminate nonessential information
- using videos, illustrations, pictures, and drawings to explain or clarify
- 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 work presented 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

Sample Lesson
