Unit 6 -Cybersecurity

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Cybersecurity

Department of Curriculum and Instruction

Belleville Public Schools

Curriculum Guide

Introduction to Coding, Grades 9-12

Cybersecurity

Belleville Board of Education

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Unit Overview

Cybersecurity explores the state of cybersecurity in the past, present, and future. Students will explore careers in Cybersecurity, learn about security threats, cryptography, network fundamentals, and defensive tools, as well as weighing legal and ethical considerations. Learn how attacks take place, and how to combat them by participating in hacking competitions

Enduring Understanding

● In order to stay safe we must understand how to limit our digital footprint and prevent tracking information that leaves us open to potential attacks.

● Government officials on a local and national level are constantly revising laws to meet the ongoing changes of our cyber society.

● Cybersecurity practices are highly complex and variable causing tensions between what the ethical duties are, to whom the ethical concern should be considered

Computer systems and networks are used to transfer data around the world.

● We must implement protection measures to secure computers and devices on a network in order to stay safe in a digital age.

● The Internet is a large, globally distributed network that is divided into layers, governed by protocols, and connects a wide variety of devices.

● Cyber terrorism has an ongoing rolling impact on a societies emotional, physical and financial well-being.

Essential Questions

● What does cybersecurity encompass?

● How is intellectual property affected by cyber security?

● Describe the ethical challenges created by digital technology?

● How can you limit your digital footprint online and offline?

● What steps could be taken nationally to prevent either an act of terrorism or the escalation of a terrorist situation?

● How are confidentiality, integrity, and availability interconnected?

● What are the ways in which data can be encrypted?

● How is the integrity of data being transported over networks safeguarded?

● How would cybersecurity specialists find incriminating information on a terrorist?

● How do forensics and digital forensics differ?

What are the underlying motivations for cyber terrorisim?

● What factors may contribute to a group resorting to terrorism and/or cyberterrorism?

● What steps would you take to prevent either an act of terrorism or the escalation of terrorist situation?

● When do you think hacking, and other cyber crimes cross the line to be called cyber terrorism?

Exit Skills

● Students will understand how the role of values and ethics affects political structures, laws, and policy decisions as it relates to cybersecurity.

● Students will develop a logical argument advocating safe/secure internet decisions in response to a presented vignette.

- Recommend or create a cost efficient cyber security plan.

● Students will be able to describe how to prevent or minimize malware attacks.

● Students will describe the process of developing secure hardware and validating that it is secure through its lifecycle.

New Jersey Student Learning Standards (NJSLS-S)

● 9.3.IT.6 - Describe trends in emerging and evolving computer technologies and their influence on IT practices.

● 9.3.IT.8 - Recognize and analyze potential IT security threats to develop and maintain security requirements.

● 9.3.IT.10 Describe the use of computer forensics to prevent and solve information technology crimes and security breaches

● 8.1.12.D.2 - Evaluate consequences of unauthorized electronic access (e.g., hacking) and disclosure, and on dissemination of personal information

TECH.8.1.12.E.1	Produce a position statement about a real world problem by developing a systematic plan of investigation with peers and experts synthesizing information from multiple sources.
TECH.8.1.12.E.2	Research and evaluate the impact on society of the unethical use of digital tools and present your research to peers.
TECH.8.1.12.F	Critical thinking, problem solving, and decision making: 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.8.1.12.F.1	Evaluate the strengths and limitations of emerging technologies and their impact on educational, career, personal and or social needs.
TECH.8.2.12	Technology Education, Engineering, Design, and Computational Thinking - Programming: All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.

Interdisciplinary Connections

ELA Standards: ● W.9-10.3. Write narratives to develop real or imagined experiences or events using effective technique, well-chosen details, and well-structured event sequences. ● RH.9-10.4. Determine the meaning of words and phrases as they are used in a text, including vocabulary describing political, social, or economic aspects of history/social studies. Computer Science and Design Thinking Standards: ● 8.1.12.D.2. Evaluate consequences of unauthorized electronic access (e.g., hacking) and disclosure, and on dissemination of personal information ● 8.1.12.D.5. Analyze the capabilities and limitations of current and emerging technology resources and assess their ELA Standards: ● RST.9-10.8. Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem. Computer Science and Design Thinking Standards: ● 8.1.12.D.5. Analyze the capabilities and limitations of current and emerging technology resources and assess their potential to address personal, social, lifelong learning, and career needs. (Students will examine a security program and conduct online research to see if the features protect the users or if the programs have obvious flaws in the programming) ELA Standards: ● 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. Computer Science and Design Thinking Standards: ● 8.1.12.D.2. Evaluate consequences of unauthorized electronic access (e.g., hacking) and disclosure, and on ELA Standards: ● RL.9-10.1. Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text. ● W.9-10.3. Write narratives to develop real or imagined experiences or events using effective technique, well-chosen details, and well-structured event sequences. Computer Science and Design Thinking Standards: ● 8.1.12.E.1 - Produce a position statement about a real world problem by developing a systematic plan of investigation with peers and experts synthesizing information from multiple sources. (Students will be given fragmentary and incomplete information about a terrorist attack, and must come up with a Somerville Public Schools Scope, Sequence, and Pacing Guide potential to address personal, social, lifelong learning, and career needs. ● 8.1.12.E.2. Research and evaluate the impact on society of the unethical use of digital tools and present your research to peers. ● 8.1.12.F.1. Evaluate the strengths and limitations of emerging technologies and their impact on educational, career, personal and or social needs. (Students will create a presentation on how they think the Bill of Rights includes or excludes online privacy) dissemination of personal information. ● 8.1.12.E.1. Produce a position statement about a real world problem by developing a systematic plan of investigation with peers and experts synthesizing information from multiple sources. ● 8.1.12.D.2. Evaluate consequences of unauthorized electronic access (e.g., hacking) and disclosure, and on dissemination of personal information.

8.1.12.NI.2	Evaluate security measures to address various common security threats.

JU.9-12.12	I can recognize, describe and distinguish unfairness and injustice at different levels of society.
8.2.12.EC.2	Assess the positive and negative impacts of emerging technologies on developing countries and evaluate how individuals, non-profit organizations, and governments have responded.
8.2.12.EC.3	Synthesize data, analyze trends, and draw conclusions regarding the effect of a technology on the individual, culture, society, and environment and share this information with the appropriate audience.
8.2.12.ETW.4	Research historical tensions between environmental and economic considerations as driven by human needs and wants in the development of a technological product and present the competing viewpoints.
CAEP.9.2.12.C.1	Review career goals and determine steps necessary for attainment.

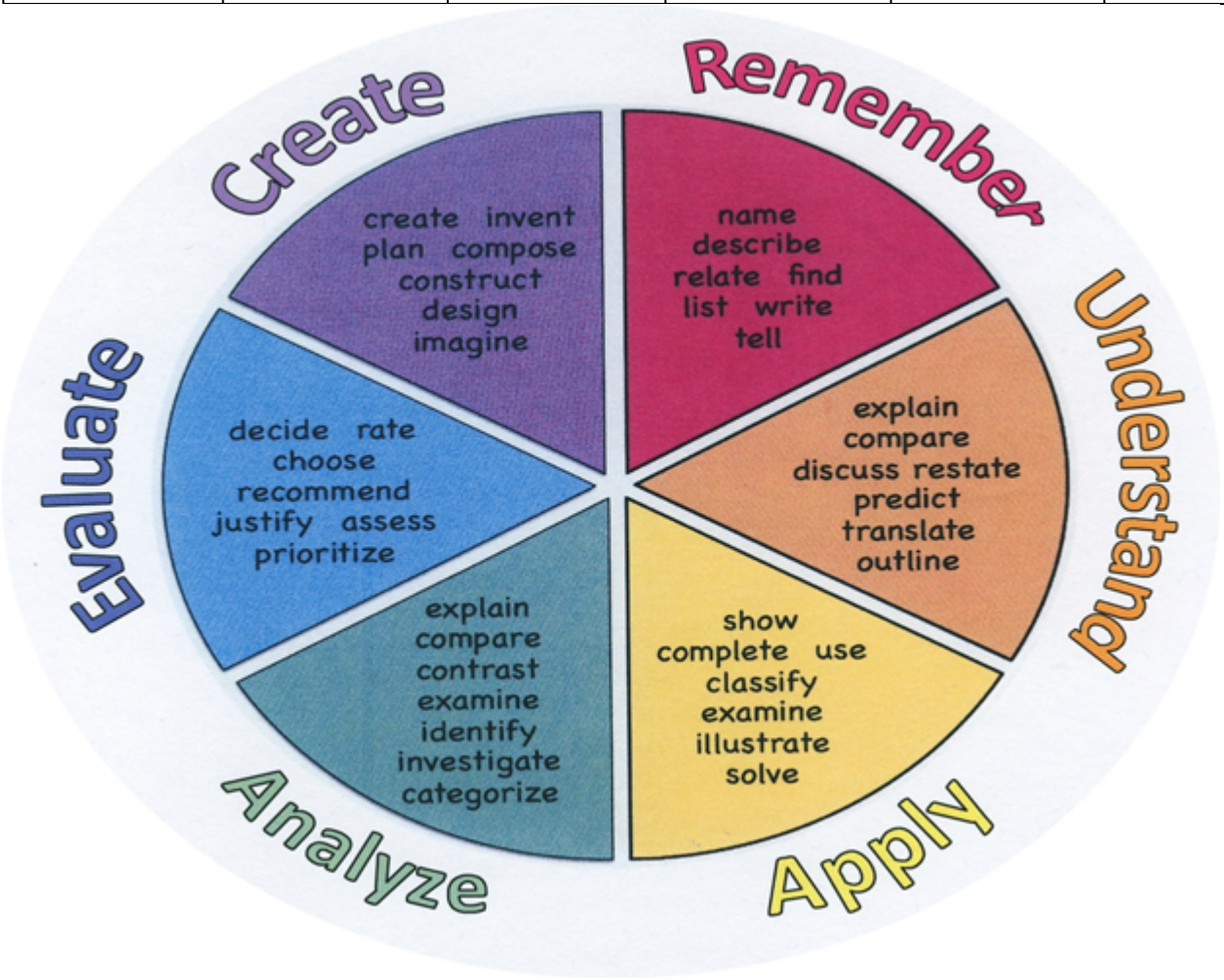
Learning Objectives

The educational objectives of the unit are:

- To prepare students with the technical knowledge and skills needed to protect and defend computer systems and networks.
- To develop students that can plan, implement, and monitor cyber security mechanisms to help ensure the protection of information technology assets.
- To develop students that can identify, analyze, and remediate computer security breaches.

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 Discuss Estimate Extrapolate Generalize Predict	Manipulate Modify Operate Subtract			



Suggested Activities & Best Practices

PBL Name: Cyber Security Briefings Goal: The purpose of this module is to place students in the drivers' seat as a Department of Homeland Security (DHS) investigative team. Students are immersed in a "real-world" scenario, given fragmentary and incomplete information, and are tasked with coming up with a workable solution to a complex problem

Role: Department of Homeland Security Investigators Audience: Department of Human Services Scenario: There are several scenarios to utilize for this project. Depending on the interests of the students. These

scenarios are designed to be an immersive game experience, with students taking an active role as investigators. Although each scenario does have one solution, students must come to their own conclusions based upon their interpretation of the evidence. In other words, solving the riddle is not the primary purpose of these scenarios. Instead, students must use their critical thinking, puzzle solving, evidence gathering, and communication skills— all while working as a team—to make an assessment of the situation and a compelling argument for a course of action. Product: Each team must prepare a presentation that tells the Department of Homeland Security (DHS) their assessment of the cyber security briefing they were given to analyze. Students must craft a government response using evidence from the documents and to make their argument. Students are free to use: ● Oral presentation ● Google slideshow/Prezi ● Video ● Google Draw PBL Resources: https://nicerc.instructure.com/co urses/6/pages/media-literacy Standards: 9.3.IT.10

● CSUnplugged ● Gencyber ● Formal Education ● Cyber Society Curriculum, Cyber Curriculum, Cyber Lessons ● National Cryptologic Museum Foundation ● CodeHS

Assessment Evidence - Checking for Understanding (CFU)

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

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

- Admit Tickets
- Anticipation Guide
- Common Benchmarks
- Compare & Contrast
- Create a Multimedia Poster
- DBQ's
- Define
- Describe

- Evaluate
- Evaluation rubrics
- Exit Tickets
- Explaining
- Fist- to-Five or Thumb-Ometer
- Illustration
- Journals
- KWL Chart
- Learning Center Activities
- Multimedia Reports
- Newspaper Headline
- Outline
- Question Stems
- Quickwrite
- Quizzes
- Red Light, Green Light
- Self- assessments
- Socratic Seminar
- Study Guide
- Surveys
- Teacher Observation Checklist
- Think, Pair, Share
- Think, Write, Pair, Share
- Top 10 List
- Unit review/Test prep
- Unit tests
- Web-Based Assessments
- Written Reports

Primary Resources & Materials

Cybersecurity - Simple Encryption (code.org)
CYBERSECURITY: LESSON PLAN | CS4HS: Computer Science for High Schools | SUNY Buffalo State College
FoT_Lesson_Plan-Cybersecurity.pdf (futureoftech.org)
Lesson 1 – The Security Mindset: Cybersecurity through Threat Modeling | Teaching Security
CERIAS - Lesson Plans / Presentation Handouts - CERIAS - Purdue University
NOVA Cybersecurity Lab Lesson Plan | PBS LearningMedia

Ancillary Resources

How to Teach Teens About Cyber Security :: Simply Speaking Blog | Lakeland Bank

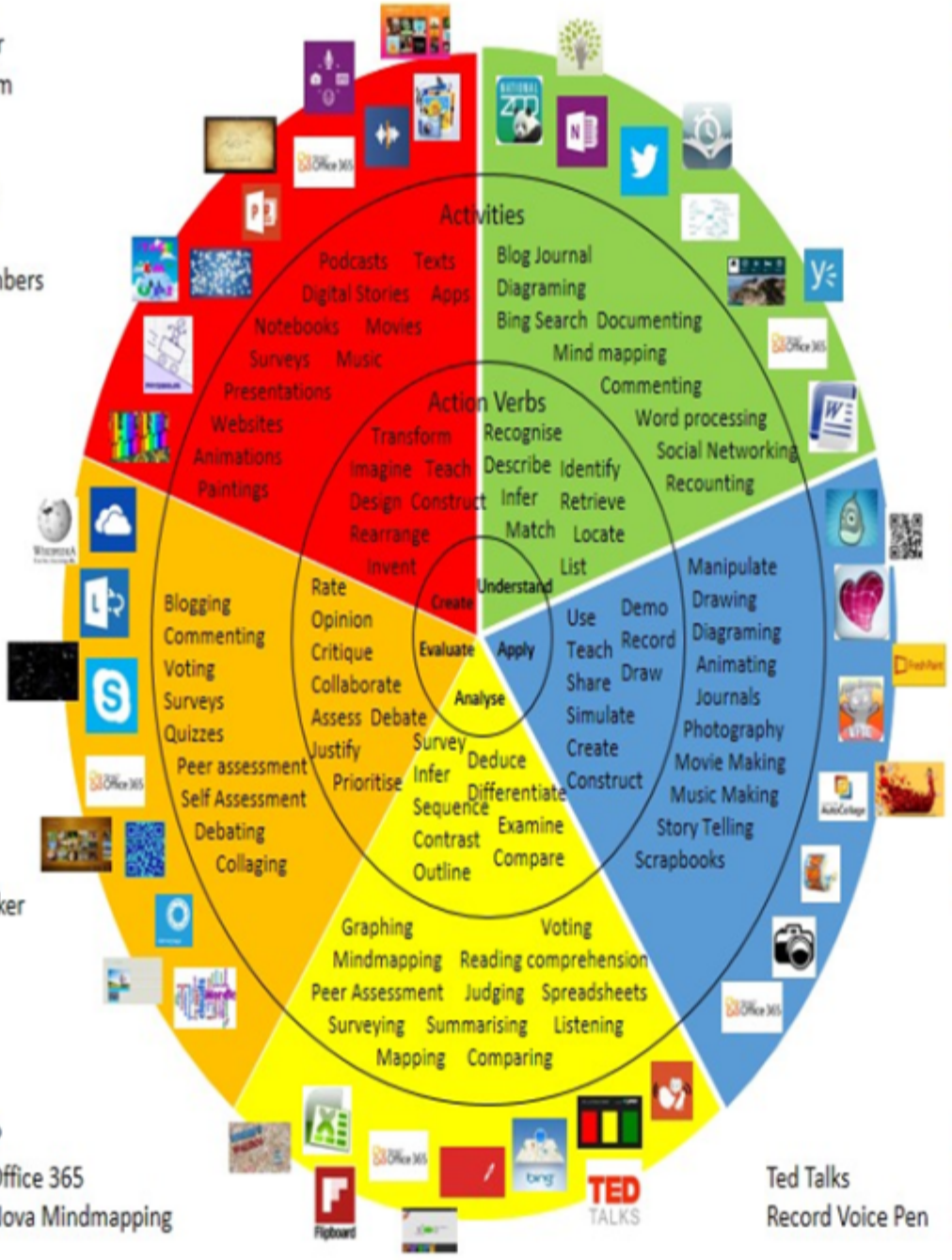
Technology Infusion

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

Win 8.1 Apps/Tools Pedagogy Wheel

Podcasts
Photostory 3
Kid Story Builder
Music Maker Jam
Paint A Story
Office 365
MS PowerPoint
Stack 'Em Up
NqSquared Numbers
Physamajig
Xylophone 8

Wikipedia
Skydrive
Lync
SkyMap
Skype
Office 365
Puzzle Touch
Easy QR
Memorylage
Life Moments
Word Cloud Maker



Where's Waldo?
MS Excel Office 365
Flipboard Nova Mindmapping

Ted Talks
Record Voice Pen

Originally taken from http://www.coetail.com/vzimmer/files/2013/02/iPadagogy-Wheel.001.jpg
And adapted for Windows 8.1 devices by Charlotte Beckhurst @CharBeckhurst

Alignment to 21st Century Skills & Technology

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

21st Century Skills/Interdisciplinary Themes

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- Communication and Collaboration
- Creativity and Innovation
- Critical thinking and Problem Solving
- ICT (Information, Communications and Technology) Literacy
- Information Literacy
- Life and Career Skills
- Media Literacy

21st Century Skills

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

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

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

Differentiation

• 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 is using 'task cards' . 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:

- 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)

- Show students how to find the hints, methods reference cards, error messages, and sample code provided within each level.
- Students struggling with a given level will be automatically directed to additional practice levels within the game.
- 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

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

Created By: Droste, George, 4/11/2021 2:44:39 PM, Type: Special Education, Published

Edit Content
Actions

- If students struggle with breaking down problems, you can use the printable Engineering Cycle Worksheet to reinforce a step-by-step problem-solving approach.
- If students struggle to follow correct syntax, provide a copy of the printable Python Syntax Guide or JavaScript Syntax Guide

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.
5. Use of digital audio-visual materials, such as YouTube, to assist the child with directions.
6. Students will have access to "How To" videos, so they may more easily follow along with directions for their assignme

- printed copy of board work/notes provided
- additional time for skill mastery
- assistive technology
- behavior management plan
- Center-Based Instruction
- check work frequently for understanding
- computer or electronic device utilizes
- extended time on tests/ quizzes
- have student repeat directions to check for understanding
- highlighted text visual presentation
- modified assignment format
- modified test content
- modified test format
- modified test length
- multi-sensory presentation
- multiple test sessions
- preferential seating
- preview of content, concepts, and vocabulary
- Provide modifications as dictated in the student's IEP/504 plan
- reduced/shortened reading assignments
- Reduced/shortened written assignments
- secure attention before giving instruction/directions
- shortened assignments
- student working with an assigned partner
- teacher initiated weekly assignment sheet
- Use open book, study guides, test prototypes

English Language Learning (ELL)

Advance notes

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

eDictionaries

When used correctly, technology never fails to transform a classroom. Allow your students to use

eDictionaries in your classroom to look up unknown words. Any regular dictionary will do, but eDictionaries allow students to hear the pronunciations of words. As you might imagine, this is extremely helpful for anyone learning a second language. If students encounter an unknown word, they can type it into an eDictionary, hear the word pronounced and either read or listen to the definition. Also, if they aren't sure how to to spell a word, many eDictionaries will allow them to speak the word to have the correct spelling displayed.

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

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

At Risk

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.

A Strategy Summary

Planned interventions are far superior to remediation approaches. Always plan to address students at risk in your learning tasks, instructions, and directions. Try to anticipate where the needs will be and then address them. Intervene as much as possible to support students at risk. If your intervention strategies are working, continue to use them. If they're not working, plan for new interventions that will help students succeed.

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.

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

[Top 10 Cyber Security Project ideas (for Beginners) - Verzeo Blogs]

Introduction to cyber security
What is cyber security?

Introduction
In this lesson students learn about cyber security and, through practical application, about ethical hacking. They also learn about the importance of cyber security in the world today, consolidating and extending their prior learning about internet safety.

Time: @60 minutes

Learning objectives
- to understand about the importance of cyber security in the world today
- to be able to explain what is meant by the term 'ethical hacking'
- to understand how to recognize potential malware attacks and how to protect data and devices.

Materials needed: Lesson plan, lesson guide, whiteboard, 'malware or made up' cards printed and cut up, Cyber Security scenarios Slide 7 printed out, 'Beat the Hacker' cards printed.

Lesson summary
1. What is malware? (10 minutes)
2. What is Cyber Security and why does it matter? (10 minutes)
3. Cyber security risks - a global problem (15 minutes)
4. Cyber security jobs (10 minutes)
5. Beat the hacker (10 minutes)
6. Review and wrap up (5 mins)

Introduction: What is malware? (10 minutes)
- Share the learning objectives on **slide 2** if you wish and use **slide 3** to lead a discussion around 'malware' and check students' current understanding.
- Give out mixed-up copies of the **malware or made up cards** to pairs of students and explain you want them to sort the cards into two piles, according to whether they think the name on the card is associated with malware or is made up (**slide 4**).
- Go through the answers using **slide 5** (and see the slide notes if want further information).

What is Cyber security and why does it matter? (10 minutes)

- Give students in their pairs a few minutes to think/pair/share the questions on **slide 6** (and to make notes if you wish).
- Lead a class discussion around their ideas, inviting them to share their own examples and using **slide 7** to clarify understanding if needed.

Cyber security risks: a Global Problem (15 minutes)

- Explain the role of the National Cyber Security Centre, part of GCHQ (**slide 8**) and follow the link to the website to show students it publishes details of weekly cyber security threats around the world.
- Give students 5-10 mins to research the website, find some interesting stories and feedback as a class.
- Highlight that, as they have seen from their research, Cyber Security is now a global problem that affects many areas of our lives.
- Give students time to think and discuss the questions on **slide 9** before discussing the answers as a class.

Cyber security jobs (10 minutes)

- Computer Misuse Act (UK): you can be sent to prison for up to 14 years and / or face a large fine for malicious hacking.
- Watch the video on **slide 10** (or find an alternative if you wish) to highlight a recent story about teenage hackers.
- Use **slides 11 and 12** to explain that hackers can also be employed 'ethically', the increase in cyber security risks has led to an increase in the demand for cyber security jobs and people can be employed as 'white-hat' (ethical) hackers.
- Students may have stories to share from their own knowledge and understanding and this can be encouraged.

Beat the hacker (10 minutes)

- Give out the **beat the hacker worksheets** to pairs or small groups (**slide 13**).
- Ensure they understand what to do and give a suitable amount of time to complete (the suggestions are only some of the possible solutions to the scenarios and they should add in their own ideas). Discuss as a class.
- Ask each pair or team to self-certify as to whether they could be good candidates for cyber-security jobs in the future given their performance on the task.

Review and wrap up (5 minutes)

- Review the learning objectives if you wish on **slide 14** and invite students to think/pair/share what they have learnt during this lesson.

Extension ideas:

- Student could conduct further research about malware before creating their own blog post or web page and providing top tips to help others avoid the pitfalls. These could be uploaded onto the school website. A good starting point is BBC Bitesize.

Differentiation

Support:

- Students may benefit by being put into mixed ability groupings to aid with discussion and

question prompts, particularly in the ‘malware or made up’ and ‘beat the hacker’ activities.
- You could give students only one or two of the scenarios for the ‘beat the hacker’ activity to focus on.

Stretch & challenge:
- Students can be asked to provide more of their own ideas in the ‘beat the hacker’ activity, researching possible solutions if appropriate. They could also come up with their own problems for others to try to solve and swop them.
- Students can be encouraged to explore cyber security further and give advice to others (see extension).

Opportunities for assessment:
- Informal observation and assessment of students’ during activities and discussion.
- More formal assessment, if wished, of their answers to the ‘beat the hacker’ activity.

Caesar cipher algorithms

Introduction

In this ‘unplugged’ lesson students create their own Caesar cipher, firstly using card before writing, testing and debugging algorithms to create a Caesar cipher to encrypt and decrypt messages.

Learning objectives

- To create and use a paper-based Caesar cipher to encrypt and decrypt messages
- To use logical reasoning to write algorithms to encrypt and decrypt messages using a Caesar cipher
- To test and debug algorithms effectively

You will need

Downloadable resources:

- Lesson plan
- Lesson slides
- Student handouts

Other resources:

Card, scissors, paper fasteners / split pins, paper - large sheets, pens

Quick links

Download lesson

Download whole unit
Programming tool

MakeCode | Python
Explore micro:bit classroom (optional)

NOMINET
Lessons created in partnership with Nominet

Lesson plan

Collapse all

Introduction: Recapping cryptography (5 minutes)

Ask students to think/pair/share what they can recall about cryptography and ciphers from the previous lesson (**slide 2**), highlighting you will be focusing on Caesar ciphers in this lesson.

Share the learning objectives on **slide 3** if you wish.

Creating card Caesar ciphers (20 minutes)

Give out the **Caesar cipher worksheet** to individuals or pairs of students (**slide 4**) and go through the instructions to check their understanding.

Ask students to collect card, scissors and paper fasteners and to create their ciphers.

Once they have created the ciphers, students can complete task B on their sheet.

Discuss their learning as a class, inviting students to share their answers to the

‘challenge’ question and highlighting examples of using logical reasoning (**slide 5**).

Caesar cipher algorithms: encryption (15 minutes)

Explain to students they are going to write an algorithm giving for encrypting a message using a Caesar cipher and ask pairs or small groups to collect A3 paper and pens to write their algorithm.

If you wish, you can discuss as a class to give some direction (there is a simple example on **slide 6**).

Once students have written their first version, ask them to write a message at the bottom of their sheet and swap their sheet with another pair or group.

Ask them to test each other’s algorithms by trying to encrypt the message using the algorithm’s instructions and to feed back any problems found in testing for the other pair/group to debug.

Discuss as a class, so all have a working algorithm for encryption and ask students to collect a new sheet of A3 paper and encrypt a message using their algorithm at the top.

Caesar cipher algorithms: decryption (10 minutes)

Ask students to write an algorithm to decrypt the message they have written using a Caesar cipher. This should be easier for them as they have already written the encryption algorithm, though you can use the simple example on **slide 7** to help if needed).

Once they have their algorithm, again ask them to swap with another pair or group who should test it using the algorithm only to try to decrypt the message and feedback any problems to be debugged.

Again, discuss as a class to address any misconceptions.

Review & wrap up (10 minutes)

Use the questions on **slide 8** to prompt review discussion in students’ pairs or groups around their learning in this lesson.

Discuss responses as a class, exploring students answers to question 5 in particular, rewarding any credible attempts generously even if the language or context is not quite right (e.g. lookup tables, variables, arrays, lists).

Review students’ learning against the learning objectives on slide 9 if you wish.

Differentiation

Support

Students may benefit from supportive pairings during the algorithm writing task, could work in a small group with adult support to sequence a set of pre-printed instructions or have a starter algorithm from which to continue.

Ensure they have a short message to decrypt/encrypt and encourage any sign of increased understanding and confidence when writing algorithms and using iteration and selection.

Stretch & challenge

Students can be challenged to create a more detailed algorithm (e.g. one that allows a user to decide the number of letters to ‘shift’).

Students can work independently or in pairs to explore using their algorithm to try to write a program in familiar software.

Opportunities for assessment

Informal observation of students’ during Caesar cipher and algorithm writing activities.

Informal assessment during class, group and individual questioning.

More formal assessment of algorithms if wishes.