The Social Network: The Snowden Effect

(Nine Weeks)

Authors

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SUBJECT/GRADE LEVEL

Subject Area: Computer Science
Grade Level: High School

Note: Some lower grade standards are listed as well (for prerequisite knowledge).

Required Materials

- String for *Network Topology Activity*
- Reliable Internet Access
- The teacher must sign up for an educator account to have access to a cyber range to complete the labs from cyber.org (https://apps.cyber.org/apply)
- The teacher must sign up for an educator account to have access to RING Cybersecurity curriculum:

  https://www.caecommunity.org/initiative/k12-ring.
- Access to the Google Site: **LINK**

Optional Materials/Resources

- Expert Individuals
  - Students might ask these experts questions to strengthen their final project.
- Classwork is aligned with a computer science course at a nearby college/university class.
  - Each high school team works in parallel with a college team to improve their work and understanding of computer science throughout the module.

Additional Required Materials if Asynchronous

- Access to "safe" virtual meeting platform.
- Clear guidelines for online teamwork expectations and behaviors.

STANDARDS

Computer Science | Computer Science Teacher Association (CSTA) K-12 Computer Science Standards, Revised 2017

- 1B-CS-01: Describe how internal and external parts of computing devices function to form a system. (**What is…?, Internet Hardware, Network Topologies, World Wide Web, Internet Search, & Traveling Information**)
    - Practice(s): Communicating About Computing: 7.2
- IB-CS-02: Model how computer hardware and software work together as a system to accomplish tasks. (**What is…?, Internet Hardware, Network Topologies, World Wide Web, Internet Search, and Traveling Information**)
    - Practice(s): Developing and Using Abstractions: 4.4
- 1B-DA-06: Organize and present collected data visually to highlight relationships and support a claim. (**Internet Hardware, Internet Search, Cyber Security and Attacks, and Final Project Choices)**
    - Practice(s): Communicating About Computing: 7.1
- IB-NI-04: Model how information is broken down into smaller pieces, transmitted as packets through multiple devices over networks and the Internet, and reassembled at the destination. (**Traveling Information**)
    - Practice(s): Developing and using Abstractions: 4.4
- 2-NI-04: Model the role of protocols in transmitting data across networks and the Internet. (**Traveling Information -> Packets, Routing, and Reliability**)
    - Practice(s): Developing and Using Abstractions: 4.4
- 2-NI-06: Apply multiple methods of encryption to model the secure transmission of information. (**Traveling Information -> Encryption & Public Keys, Your Data Your Network**)
    - Practice(s): Developing and Using Abstractions: 4.4
- IB-NI-05: Discuss real-world cybersecurity problems and how personal information can be protected. (**Your Data Your Network, Cybersecurity -> Cybersecurity and Attacks**)
    - Practice(s): Recognizing and Defining Computational Problems: 3.1
- 3A-NI-04: Evaluate the scalability and reliability of networks, by describing the relationship between routers, switches, servers, topology, and addressing. (**Network Topologies & Traveling Information)**
    - Practice(s) Developing and Usuing Abstractions: 4.1
- 3A-NI-05: Give examples to illustrate how sensitive data can be affected by malware and other attacks. (**Your Data Your Network, Cybersecurity -> Cybersecurity and Attacks**)
    - Practice(s) Communicating about Computing 7.2
- 3B-NI-05: Describe the issues that impact network functionality (e.g., bandwidth, load, delay, topology). (**Network Topology & Traveling Information**)
    - Practice(s) Communicating about Computing: 7.2
- 3B-NI-04: Compare ways software developers protect devices and information from unauthorized access. (**Traveling Information -> Encryption & Public Keys**)
    - Communicating About Computing: 7.2

Additional Standards (Students should adhere to these standards)

- 1B-1C-20: Seek diverse perspectives for the purpose of improving computational artifacts.
    - Classroom discussions, teamwork projects, virtual classroom input (Google Slideshows, Google Documents, etc.)
- 1B-1C-21: Use public domain or creative commons media, and refrain from copying or using material created by others without permission.
    - Classroom discussions, teamwork projects, virtual classroom input (Google Slideshows, Google Documents, etc.)

English Language Arts Standards | Common Core State

- CCSS.ELA-LITERACY.W.11-12.1: Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
    - CCSS.ELA-LITERACY.SL.11-12.1.A: Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.
- CCSS.ELA-LITERACY.W.11-12.2: Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.
- CCSS.ELA-LITERACY.W.11-12.4: Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
- CCSS.ELA-LITERACY.W.11-12.6: Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.
- CCSS.ELA-LITERACY.W.11-12.8: Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.

LESSON OBJECTIVE(S)

What is a Network and the Internet?

Students will be able to

1. Describe computer networks and network technologies.
2. Describe what is the internet
3. List hardware associated with the internet.
4. Provide evidence of their understanding of the internet, networks, and associated hardware by discussing these topics with their peers and providing references to justify their statements and using correct vocabulary associated with computer science.

Internet Hardware

Students will be able to

1. Execute a thorough search for internet hardware to better understand each component.
2. Construct a dating profile for their selected internet hardware component to share with their peers.
3. Distinguish among the dating profiles to determine how each hardware component is connected to each other and best suits their own profile by using a comparison chart.

Network Topologies

Students will be able to

1. Demonstrate (as a team) the different network topologies.
2. Justify their conclusions by creating different network topologies and discussing each of the topology configurations with their peers.
3. Synthesize their understanding of network topologies by writing a short summary of their understanding of network topologies.

World Wide Web (www...)

Students will be able to

1. Distinguish the differences and similarities between the world wide web and the internet and share their understandings with their peers using Jamboard.

Internet Search

Students will be able to

1. Define terms associated with an internet search (i.e., HTTP, HTML, IP addresses, etc.).
2. Synthesize how internet search works by creating an infographic about this process and sharing these figures with their peers.

LESSON OBJECTIVE(S)

Traveling Information

Students will be able to

1. Complete a Code.org activity (Slide 2) to demonstrate an understanding of how to
    a. Explain why protocols are necessary to overcome the underlying unreliability of the internet.
    b. Develop a protocol for reliable communication on the internet.
    c. Justify the need for acknowledgments and packet numbering in TCP.
2. Complete three courses related to Cisco Packet Tracers to demonstrate understanding.
    a. Course 1
        i. Module 1:
            1. Installing and Understanding the Cisco Packet Tracer Interface
        ii. Module 2:
            1. Learning about Packet Tracer file types, building a home network, and summarizing the course.
    b. Course 2
        i. Module 1:
            1. Connecting devices using wireless technologies
        ii. Module 2:
            1. Structuring wiring and doing PT simulation
            2. Using a Network controller, and summarizing the course.
    c. Course 3
        i. Module 1
            1. Learning about IoT Devices in Packet Tracer
            2. Creating and controlling your Smart Home network
        ii. Module 2
            1. Investigating environment controls in Packet Tracer, creating an IoT Thing in Packet Tracer, and summarizing the course.
3. Complete the Wireshark lab (p. 12, Question 6) to demonstrate
    a. Understanding on how to use Wireshark
    b. Synthesize this understanding to respond to a specific prompt.

4. Complete the *Hide and Seek* activity to
    a. Understand the basics of Network Traffic analysis. (Understand)
    b. Examine information that might indicate unexpected activity on a network. (Analyze)
    c. Appraise detailed data from TCP data streams to support digital forensics investigations. (Evaluate)
    d. Investigate network traffic and extract useful information from a PCAP file. (Create)
    e. Critique which information can and cannot be sent in plaintext over the web, and why. (Evaluate)
5. Complete a Code.org activity to demonstrate an understanding of
    a. Cracking a message encrypted with a Caesar cipher using a Caesar Cipher Widget.
    b. Cracking a message encrypted with random substitute using Frequency Analysis.
    c. Explain the weaknesses and security flaws of substitution ciphers.
    d. Explain why encryption is an important need for everyday life on the internet.
6. Complete an extra Code.org activity (Handbook for in-class activities pp. 235-247) credit assignment to
    a. Simulate flowing through the internet to learn about internet connections, URLs, IP Addresses, and the DNS in a virtual environment.

Your Data Your Network

Students will be able to

1. Equip high school students with the knowledge and skills to secure their data when using both public and private networks.
2. Develop a comprehensive checklist to ensure their data remains protected from potential threats.
3. Raise awareness among their peers about the permanence of online content and the concept of digital footprints.
4. Learn how to search for and find social media posts that a user may have thought were deleted and are still accessible on the web.

Cybersecurity

Students will be able to

1. Complete a short (ten-question) quiz and pass with a rate of 90% (or higher) related to the OSI, TCP/IP Models, and how UDP is (or is not) related to the models after reading about the models.
2. Describe each type of attack related to each OSI layer in a Google Slideshow.
3. Discuss a case study related to malware after completing some virtual lessons.
4. Compare and contrast different types of social engineering techniques after completing virtual lessons and lab.
5. Compare and contrast types of attacks and their associated characteristics by completing a lab.
6. Show understanding by completing challenges related to cybersecurity.

CAREER CONNECTION(S)

Mentor Background:

Hunter Sylvester: U. S. Army Engineer Research and Development (ERDC); Vicksburg, Mississippi

Background: Hunter Sylvester has been with ERDC for 2 years. He originally taught elementary and high school and made the transition into research. His background is in mathematics, biostatistics, and data science. He attends the University of Mississippi Medical Center for a Ph.D. in biostatistics and data science.

STEM Careers:

Computer science is the study of computation and information. It is a broad field that encompasses a wide range of topics, from the theoretical foundations of computation to the design and implementation of computer systems. Computer science is a rapidly growing field, with new developments constantly emerging.

Computer science is used in a wide variety of fields, including business, engineering, medicine, and science. It is also used in the development of new technologies, such as artificial intelligence, robotics, and the internet.

Computer science is a challenging but rewarding field. It offers the opportunity to work on cutting-edge technologies and to make a real-world impact. If you are interested in problem-solving, creativity, and innovation, then computer science may be the right field for you.

Here are some of the subfields of computer science:

- Artificial intelligence
- Computer architecture
- Computer graphics
- Computer networks
- Computer security
- Databases
- Information theory
- Machine learning
- Natural language processing
- Software engineering
- Theoretical computer science

Computer science is a fascinating and ever-changing field. If you are interested in learning more about it, there are many resources available online and in libraries. You can also find many computer science courses offered at colleges and universities.

ORGANIZATION

This module focuses on information related to

- Networks
- Internet
- Internet Hardware
- Network Topologies
- World Wide Web
- Internet Searches
- How Information Travels on the Internet
- Your Data Your Network
- Cybersecurity

While the focus on this module is on cybersecurity, students will be engaged in learning about cybersecurity after watching short movie clips (i.e., *Snowden*, *The Matrix*, etc.) related to the bulleted topics. In addition, the SWBAT Objectives are listed for students to know how they will accomplish each task and gain success in learning about cybersecurity. Finally, and these final two options are optional, students may talk about cybersecurity and computer science-related topics with experts in the field.

Additionally, students explore computer science (specifically cybersecurity content) by trying many different cybersecurity-related activities in interactive ways (interactive presentations, quizzes, working in a "sandbox" environment to implement cybersecurity strategies they learn about, etc.) to increase their knowledge and skills in computer science. Furthermore, students will conduct some research to extend their skills in this content.

Furthermore, multiple students will explain what they know, and what more they might want to learn with their peers, classroom facilitators, and computer science experts. This communication might be done with discussion boards, creating graphics that will be critiqued by their peers, and responding to challenges presented in various modules within this course. Students can further elaborate what they have learned from participating in this module by sharing a PSA, sharing their short presentations, and other research (on the designated pages provided on the Google Site).

In conclusion, students must demonstrate mastery by creating the assignments required for this course. You can assess these artifacts for student skill and knowledge. In addition, students will complete a short quiz and select a final "capstone" project to show their growth.

ENGAGEMENT

Brief Description:

- Videos
- Objectives
- Speak with an Expert (Optional)
- Partner with college/university class (Optional)

Procedures:

- Objectives are provided at the start of each topic in the module. These objectives can help students understand how they might acquire information regarding the content.
- Your classes will complete several assignments that could be improved with the aid of an expert's advice. This source of expertise might also come from a class of computer science students at a nearby college or university as well. Mentors can increase overall student engagement.

EXPLORATION

Brief Description:

- Videos
- Articles
- Interactive Lessons
- Research

Procedures:

- Your computer science students might explore information concerning each topic related in this module by watching the videos, reading the provided articles, and completing the interactive lessons. In addition, your students might also search for quality resources that can lead to deeper understanding of the content present in this module.

EXPLANATION

Brief Description:

- Discussion board
- Speed dating profile
- Infographic creation
- Reflective summaries
- In class discussions
- Program critiques
- Challenge responses
- Slideshow input
- Poster design (Optional)

Procedures:

- Students will explain what they have learned during in class discussions and online forums (i.e., Jamboards, Google Doc, etc.). Your students will also create dating profiles for particular vocabulary terms that relate information regarding their selected terms. In addition, students must convey a clear and concise understanding of what they learn in an infographic, poster, and other forms of writing to their peers.

ELABORATION

Brief Description:

- Completing comparison charts
- Peer-to-Peer feedback
- In class discussion
- Case study responses
- Infographic
- Public Service Announcement
- Written reflections, summaries, and other assignments

Procedures:

- Students must use feedback from you and their peers to improve their work (i.e., writing assignments, comparison charts, etc.). In addition, your students must use appropriate vocabulary to further elaborate what they know about the computer science topics they learn as they progress through the module. Furthermore, students must use all feedback to strengthen their arguments regarding their writing and case study responses.

EVALUATION

Brief Description:

- All items from Explanation and Elaboration sections along with
    - A short quiz
    - Final project.

Procedures:

- You must evaluate all student work as they move through this module. Listen and facilitate all peer-to-peer discussions, provide feedback on all submitted assignments, and model appropriate computer science actions to provide instant feedback for all students.
- Furthermore, assessments include a short quiz and final project. All students should receive timely feedback and grading to ensure they know their current progress toward learning the computer science content covered in this module.

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