Wall Township Public Schools	Board Approval Date:

Course Title: INTRO TO CYBERSECURITY & ARTIFICIAL INTELLIGENCE

Course Description: The focus of instruction will be on the foundational concepts of both cybersecurity and artificial intelligence. Students will explore key principles of cybersecurity, including network protection, identifying vulnerabilities, and understanding ethical hacking techniques to defend against cyber threats. They will also dive into AI fundamentals, learning how machines can be trained to solve problems, recognize patterns, and make decisions. Through hands-on labs, students will engage with basic coding exercises and AI models, while also practicing critical thinking and problem-solving strategies. The course will integrate real-world scenarios, addressing current challenges in cybersecurity and AI ethics, as well as the societal implications of these technologies.

New Jersey Student Learning Standards

- 2020 New Jersey Student Learning Standards – Computer Science and Design Thinking Introduction
- 2020 New Jersey Student Learning Standards – Career Readiness, Life Literacies, and Key Skills

Course Sequence & Pacing

Unit Title	Estimated Number of Instructional Periods
Unit 1: Cybersecurity & You	14
Unit 2: Cryptography	14
Unit 3: System Administration	20
Unit 4: IT Concepts	20
Unit 5: IT Infrastructure	25
Unit 6: Data Security	24
Unit 7: Intro to AI & ML	10
Unit 8: Training AI & AI Risks	8

Unit 1

Desired Results

Unit 1 Title: Cybersecurity & You

Unit Summary:

In this unit, students delve into key areas such as personal data collection, the reliability of online information, cyber ethics and laws, personal data security, cybersecurity essentials, and strategies to combat common cyber threats and their prevention, equipping individuals with the knowledge to navigate the digital landscape responsibly and securely.

Learning Standards

NJSLS:

- 8.1.12.NI.1: Evaluate the scalability and reliability of networks, by describing the relationship between routers, switches, servers, topology, and addressing.
- 8.1.12.NI.2: Evaluate security measures to address various common security threats.
- 8.1.12.NI.3: Explain how the needs of users and the sensitivity of data determine the level of security implemented.
- 8.1.12.NI.4: Explain how decisions on methods to protect data are influenced by whether the data is at rest, in transit, or in use.
- 8.1.12.IC.1: Evaluate the ways computing impacts personal, ethical, social, economic, and cultural practices.
- 8.1.12.IC.2: Test and refine computational artifacts to reduce bias and equity deficits.
- 8.1.12.IC.3: Predict the potential impacts and implications of emerging technologies on larger social, economic, and political structures, using evidence from credible sources.
- 8.1.12.DA.2: Describe the trade-offs in how and where data is organized and stored.
- 8.1.12.AP.4: Design and iteratively develop computational artifacts for practical intent, personal expression, or to address a societal issue.
- 8.1.12.AP.7: Collaboratively design and develop programs and artifacts for broad audiences by incorporating feedback from users.
- 8.1.12.AP.8: Evaluate and refine computational artifacts to make them more usable and accessible.
- 8.2.12.ED.1: Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers.
- 8.2.12.ED.4: Design a product or system that addresses a global problem and document decisions made based on research, constraints, trade-offs, and aesthetic and ethical considerations and share this information with an appropriate audience.

Interdisciplinary Connections

Career Readiness, Life Literacies, & Key Skills *(CLKS)*:

- 9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).

- 9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition (e.g., 2.1.12.PGD.1).
- 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).
- 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).
- 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.
- 9.4.12.DC.1: Explain the beneficial and harmful effects that intellectual property laws can have on the creation and sharing of content (e.g., 6.1.12.CivicsPR.16.a).
- 9.4.12.DC.2: Compare and contrast international differences in copyright laws and ethics.
- 9.4.12.DC.3: Evaluate the social and economic implications of privacy in the context of safety, law, or ethics (e.g., 6.3.12.HistoryCA.1).
- 9.4.12.DC.4: Explain the privacy concerns related to the collection of data (e.g., cookies) and generation of data through automated processes that may not be evident to users (e.g., 8.1.12.NI.3).
- 9.4.12.DC.5: Debate laws and regulations that impact the development and use of software.
- 9.4.12.DC.6: Select information to post online that positively impacts personal image and future college and career opportunities.
- 9.4.12.DC.7: Evaluate the influence of digital communities on the nature, content and responsibilities of careers, and other aspects of society (e.g., 6.1.12.CivicsPD.16.a).
- 9.4.12.DC.8: Explain how increased network connectivity and computing capabilities of everyday objects allow for innovative technological approaches to climate protection.
- 9.4.12.IML.1: Compare search browsers and recognize features that allow for filtering of information.
- 9.4.12.IML.2: Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources (e.g., NJSLSA.W8, SocialStudies Practice: Gathering and Evaluating Sources.
- 9.4.12.IML.8: Evaluate media sources for point of view, bias, and motivations (e.g., NJSLSA.R6, 7.1.AL.IPRET.6).

- 9.4.12.IML.9: Analyze the decisions creators make to reveal explicit and implicit messages within information and media (e.g., 1.5.12acc.C2a, 7.1.IL.IPRET.4).
- 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task (e.g., W.11-12.6.).
- 9.4.12.TL.3: Analyze the effectiveness of the process and quality of collaborative environments.
- 9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem (e.g., 7.1.AL.IPERS.6).

Interdisciplinary Connections:

Science and Engineering Practices:

- Develop a model based on evidence to illustrate the relationships between systems or between components of a system.
- Use a model to predict the relationships between systems or between components of a system.
- Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.
- Apply scientific ideas to solve a design problem, taking into account possible unanticipated effects.
- Communicate scientific and technical information (e.g. about the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically).
- Create a computational model or simulation of a phenomenon, designed device, process, or system.
- Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.
- Evaluate the claims, evidence, and reasoning behind currently accepted explanations or solutions to determine the merits of arguments.
- Evaluate the validity and reliability of multiple claims that appear in scientific and technical texts or media reports, verifying the data when possible.

- Use mathematical and/or computational representations of phenomena or design solutions to support explanations.
- Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible.
- Make and defend a claim based on evidence about the natural world that reflects scientific knowledge, and student-generated evidence.
- Apply scientific reasoning to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion.
- Construct an oral and written argument or counter-arguments based on data and evidence.
- Evaluate a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.

Engineering Design Standards:

- HS-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
- HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
- HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
- HS-ETS1-4 Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

Learning Targets	
Unit Essential Questions:	**Unit Enduring Understandings:**

• How does our digital footprint impact our personal privacy and future opportunities? • What strategies can individuals use to protect their personal data and online identity? • What are the ethical and legal responsibilities of individuals and organizations in cyberspace? • How can understanding cybersecurity principles help prevent common cyber attacks? • Why is it important to evaluate the reliability and security of online information and platforms?	• Every digital interaction contributes to a personal digital footprint that can affect one's privacy, reputation, and future. • Protecting personal data requires informed decisions, strong security practices, and an awareness of the risks involved in sharing information online. • Cyber ethics and laws provide a framework for responsible digital behavior, safeguarding both individuals and communities. • Knowledge of cybersecurity fundamentals empowers users to recognize threats, apply preventive measures, and respond effectively to cyber incidents. • Critical thinking and awareness of information reliability are essential for navigating today's complex digital landscape.
Vocabulary: digital footprint, personal data, data security, cyberbullying, cybersecurity, phishing, malware, firewall, encryption, cia triad, cyber ethics, copyright, identity theft, cyber law	
Students will be able to: • Analyze the impact of social media and technology use on the lives of teenagers • Explain how one's digital footprint can impact their future employment options • Analyze their own digital footprint and explain how they can maintain a positive digital footprint • Define cyberbullying • Explain how to respond to cyberbullying • Explain why companies collect data and what they do with it	

- Analyze the benefits and consequences of data collection that may or may not be evidence to users
- Consider the ethics of data collection with relation to privacy concerns
- Define personally identifiable information
- Explain personal data collection in the context of the law (GDPR, CCPA, and privacy policies)
- Evaluate the accuracy, relevance, comprehensiveness, appropriateness, and bias of electronic information resources
- Evaluate quality of digital resources for reliability
- Reflect on the growth of artificial intelligence in terms of trustworthy content
- Explore and use search engine keywords and special characters to refine search results
- Identify the difference between ethical hacking and malicious hacking
- Discuss the principles of cyber ethics, focusing on responsible online behavior.
- Discuss potential legal consequences of unethical online behavior
- Debate intellectual laws and the beneficial and harmful effects that these laws have on innovation
- Explain password best practices
- Define authentication terms: passphrase, multifactor authentication, 2FA, biometric authentication, password managers
- Evaluate different forms of authentication
- Explain how to use privacy settings on their browser to enhance security
- Consider the tradeoffs between usability and security measures
- Define basic cybersecurity terminology
- Explain the importance of information security and the CIA Triad (Confidentiality, Integrity, Availability)
- Analyze how the AAA Security Framework (Authentication, Authorization, and Accounting) helps protect online information
- Identify potential security risks associated with the Internet of Things (IoT) devices.
- Identify and define different types of cyberattacks (malware, viruses, ransomware, spyware, phishing)
- Explain the importance of preventative measures like antivirus software, updates, HTTPS, and firewalls
- Analyze real-world examples of phishing attacks and develop strategies for identifying suspicious online activities

Learning Activities & Differentiation: *(Amistad & Holocaust, Asian American & Pacific Islanders, Climate Change, LGBTQ and People with Disabilities, Diversity, Equity & Inclusion [DEI])*

Learning Activities:

- Digital Footprint Self-Analysis: Students examine their own digital footprint and reflect on how it may affect future opportunities, using case studies of teens and public figures.
- Cyberbullying Role-Play and Response Planning: Interactive role-play scenarios with guided discussions to promote empathy and appropriate response strategies.
- Data Privacy Investigation: Students analyze real-world examples of data collection (e.g., from Google or TikTok) and discuss ethical and legal implications including CCPA and GDPR.
- Media Literacy Challenges: Evaluate real online resources for accuracy, bias, and reliability using AI-generated vs. human-generated content.
- Search Strategy Games: Practice advanced search engine techniques using keywords, filters, and Boolean logic through scavenger-hunt style activities.

Differentiation Strategies:

- For Advanced Learners: Offer in-depth research tasks on evolving cybersecurity threats or laws (e.g., AI-generated deepfakes, IoT vulnerabilities), lead peer discussions, or design public service announcements.
- For Struggling Learners: Use structured graphic organizers for evaluating websites and analyzing cyber laws; provide sentence frames and simplified summaries of legal terms and ethical concepts.
- For English Language Learners: Include vocabulary banks with visual cues, bilingual glossaries of key cybersecurity terms, and video explainers with captions.
- Universal Design for Learning (UDL): Provide multiple content formats (articles, videos, infographics); offer flexible product options (infographic, podcast, presentation); allow flexible pacing through checkpoints and asynchronous discussion threads.

Education Connections:

- Highlight diverse voices and contributions in cybersecurity and data privacy, including underrepresented groups in

tech fields
- Discuss how secure design and privacy settings support accessibility and safety for people with disabilities and LGBTQ+ individuals
- Explore ethical concerns around surveillance, data collection, and misuse of information through historical and social justice lenses
- Examine how AI and digital security impact marginalized communities, emphasizing the importance of equity in technology use and protection
- Encourage critical conversations about who has access to digital safety tools and how bias in algorithms can reinforce inequality

Assessment Evidence

Formative Assessments:

- CodeHS exercises
    - Example Assignment: Digital Footprint and Responsibility

      Students explore the impact of social media and technology on teenagers, covering topics like digital footprints, the rise of social media screenings, cyberbullying, and the importance of updating privacy settings.
    - Example Assignment: Cyber Ethics and Laws

      This lesson navigates through cyber ethics, differentiating between ethics and laws, exploring legal consequences, copyright in education, the process of obtaining permissions, and the pros and cons of intellectual property laws.
- CodeHS Checks for Understanding

Summative Assessments:

- Unit Project: PSA/Infographic

Common Benchmark Assessments:

- Unit Project: PSA/Infographic

Alternative Assessments:

- CodeHS Unit Quiz

Core Instructional & Supplemental Materials

Core Materials:

- CodeHS Fundamentals of Cybersecurity – Module 1: Cybersecurity and You
- CodeHS interactive lessons, quizzes, and reflections on digital footprint, personal data, and cyber ethics
- Hands-on activities and simulations exploring cybersecurity threats and prevention strategies
- CodeHS cybersecurity vocabulary reference sheets and concept checks
- Browser and privacy setting exploration tools used in security practice lessons
- Articles and video content covering cyber laws, ethical behavior online, and real-world case studies

Supplemental Materials:

- Guided note-taking organizers for key frameworks like the CIA Triad and AAA Security Model
- Visuals and diagrams of data collection processes, security layers, and personal data flows
- Ethical dilemma cards and debate protocols for discussing online behavior and privacy issues
- Self-assessment tools for evaluating digital footprint and privacy practices
- Sample phishing emails, security trade-off scenarios, and role-play exercises for prevention strategy practice
- Checklists for evaluating website credibility, privacy policies, and search result reliability
- Graphic organizers and glossaries to support English Language Learners and students with diverse learning needs
- Rubrics for evaluating digital footprint reflections, cyber ethics debates, and data security action plans

Accommodations and Modifications: Students with Disabilities, English Language Learners, Students at Risk of Failure, Students with 504s, Gifted & Talented Students

Specific Strategies and Practices that Support Students with Disabilities:

Students receiving Special Education programming have specific goals and objectives, as well as accommodations and modifications outlined within their Individualized Education Plans (IEP) due to an identified disability and/or diagnosis. In addition to exposure to the general education curriculum, the instruction is differentiated based upon the student's needs. The IEP acts as a supplemental curriculum guide inclusive of instructional strategies that support each learner.

- Additional time - Review of directions - Follow a routine/schedule - Verbal and visual cues regarding directions and staying on task

Specific Strategies and Practices that Support English Language Learners

English language learner (ELL) is a national-origin-minority student who is limited-English-proficient. This term is often preferred over limited-English-proficient (LEP) as it highlights accomplishments rather than deficits.

- Pre-teaching of vocabulary and concepts - Personal Glossary - Visual learning, including graphic organizers - Cooperative learning groups

Students at Risk of Failure

- Alternative Assessments - Learning Contracts - Tiered Level of Supports - Group Work Choice

Students with 504 Plans

Teachers are responsible for implementing designated services and strategies identified on a student's 504 Plan.
504 plans are formal plans that schools develop to give kids the support they need and covers any condition that limits daily activities in a major way. Students' accommodations are outlined in their individual 504 plan.

Specific Strategies and Practices that Support Gifted & Talented Students

It is critical that all teachers are able to recognize a high-ability student who may need more depth and complexity in instruction.

- Small Group In-Depth Instruction - Alternative Assessments

Unit 2

Desired Results

Unit 2 Title: Cryptography

Unit Summary:

In this unit, students will dive into the history of cryptography systems, the motivation behind using encryption systems, and modern cryptography systems. This includes explaining the core concepts of Public Key Infrastructure and hash functions. Students will also explore the importance of digital certificates, and authentication methods.

Learning Standards

NJSLS:

- 8.1.12.CS.1: Describe ways in which integrated systems hide underlying implementation details to simplify user experiences.
- 8.1.12.CS.4: Develop guidelines that convey systematic troubleshooting strategies that others can use to identify and fix errors.
- 8.1.12.NI.2: Evaluate security measures to address various common security threats.
- 8.1.12.NI.3: Explain how the needs of users and the sensitivity of data determine the level of security implemented.
- 8.1.12.NI.4: Explain how decisions on methods to protect data are influenced by whether the data is at rest, in transit, or in use.
- 8.1.12.IC.1: Evaluate the ways computing impacts personal, ethical, social, economic, and cultural practices.
- 8.1.12.IC.3: Predict the potential impacts and implications of emerging technologies on larger social, economic, and political structures, using evidence from credible sources.
- 8.1.12.DA.2: Describe the trade-offs in how and where data is organized and stored.
- 8.1.12.DA.3: Translate between decimal numbers and binary numbers.
- 8.1.12.DA.4: Explain the relationship between binary numbers and the storage and use of data in a computing device.
- 8.1.12.AP.1: Design algorithms to solve computational problems using a combination of original and existing algorithms.
- 8.1.12.AP.4: Design and iteratively develop computational artifacts for practical intent, personal expression, or to address a societal issue.
- 8.1.12.AP.5: Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects.

- 8.1.12.AP.6: Create artifacts by using procedures within a program, combinations of data and procedures, or independent but interrelated programs.
- 8.1.12.AP.7: Collaboratively design and develop programs and artifacts for broad audiences by incorporating feedback from users.
- 8.1.12.AP.8: Evaluate and refine computational artifacts to make them more usable and accessible.
- 8.1.12.AP.9: Collaboratively document and present design decisions in the development of complex programs.
- 8.2.12.ED.1: Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers.
- 8.2.12.ED.4: Design a product or system that addresses a global problem and document decisions made based on research, constraints, trade-offs, and aesthetic and ethical considerations and share this information with an appropriate audience.
- 8.2.12.ITH.1: Analyze a product to determine the impact that economic, political, social, and/or cultural factors have had on its design, including its design constraints.
- 8.2.12.ITH.2: Propose an innovation to meet future demands supported by an analysis of the potential costs, benefits, trade-offs, and risks related to the use of the innovation.
- 8.2.12.ITH.3: Analyze the impact that globalization, social media, and access to open source technologies has had on innovation and on a society's economy, politics, and culture.
- 8.2.12.EC.1: Analyze controversial technological issues and determine the degree to which individuals, businesses, and governments have an ethical role in decisions that are made.

Interdisciplinary Connections

Career Readiness, Life Literacies, & Key Skills *(CLKS)*:

- 9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
- 9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition (e.g., 2.1.12.PGD.1).
- 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).
- 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).

- 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.
- 9.4.12.DC.1: Explain the beneficial and harmful effects that intellectual property laws can have on the creation and sharing of content (e.g., 6.1.12.CivicsPR.16.a).
- 9.4.12.DC.3: Evaluate the social and economic implications of privacy in the context of safety, law, or ethics (e.g., 6.3.12.HistoryCA.1).
- 9.4.12.DC.4: Explain the privacy concerns related to the collection of data (e.g., cookies) and generation of data through automated processes that may not be evident to users (e.g., 8.1.12.NI.3).
- 9.4.12.DC.5: Debate laws and regulations that impact the development and use of software.
- 9.4.12.DC.6: Select information to post online that positively impacts personal image and future college and career opportunities.
- 9.4.12.IML.1: Compare search browsers and recognize features that allow for filtering of information.
- 9.4.12.IML.2: Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources (e.g., NJSLSA.W8, SocialStudies Practice: Gathering and Evaluating Sources.
- 9.4.12.IML.7: Develop an argument to support a claim regarding a current workplace or societal/ethical issue such as climate change (e.g., NJSLSA.W1, 7.1.AL.PRSNT.4).
- 9.4.12.IML.8: Evaluate media sources for point of view, bias, and motivations (e.g., NJSLSA.R6, 7.1.AL.IPRET.6).
- 9.4.12.IML.9: Analyze the decisions creators make to reveal explicit and implicit messages within information and media (e.g., 1.5.12acc.C2a, 7.1.IL.IPRET.4).
- 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task (e.g., W.11-12.6.).
- 9.4.12.TL.3: Analyze the effectiveness of the process and quality of collaborative environments.
- 9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem (e.g., 7.1.AL.IPERS.6).

Interdisciplinary Connections:

Science and Engineering Practices:

- Develop a model based on evidence to illustrate the relationships between systems or between components of a system.
- Use a model to predict the relationships between systems or between components of a system.
- Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.
- Use mathematical and/or computational representations of phenomena or design solutions to support explanations.
- Create a computational model or simulation of a phenomenon, designed device, process, or system.
- Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.
- Evaluate the validity and reliability of multiple claims that appear in scientific and technical texts or media reports, verifying the data when possible.
- Apply scientific reasoning to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion.
- Construct an oral and written argument or counter-arguments based on data and evidence.
- Design or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.
- Evaluate a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.

Engineering Design Standards:

- HS-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
- HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

- HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
- HS-ETS1-4 Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

Learning Targets

Unit Essential Questions:

- How has cryptography evolved from ancient times to modern-day digital systems?
- Why is encryption essential for maintaining privacy and security in digital communication?
- What are the differences between symmetric and asymmetric encryption, and when is each method used?
- How do digital certificates and authentication methods help verify identity and ensure secure transactions?
- How can cryptographic concepts be applied to solve real-world problems creatively, such as designing an escape room?

Unit Enduring Understandings:

- Cryptography has a rich history and continues to evolve in response to technological and security needs.
- Encryption plays a critical role in protecting data by making information unreadable to unauthorized users.
- Symmetric and asymmetric encryption are foundational concepts in modern cryptography, each serving different purposes in secure communication.
- Digital certificates and authentication mechanisms are essential tools in ensuring trust and identity in online environments.
- Applying cryptographic techniques in creative contexts, such as escape rooms, reinforces problem-solving, design, and real-world application of cybersecurity concepts.

Vocabulary: cryptography, encryption, decryption, cipher, hash, public key, private key, authentication, certificate, plaintext, ciphertext

Students will be able to:

- Decode messages encrypted with Caesar and Vigenere ciphers
- Explain the concept of encryption and its role in secure communication
- Identify and compare different historical and modern encryption techniques
- Analyze the limitations of certain decryption methods (brute force, letter frequency analysis)
- Discuss the potential future applications of cryptography
- Explain the characteristics of symmetric algorithms and use them to encode and decode text. Specific ciphers include block, substitution, and transposition ciphers.
- Compare and contrast the strengths and weaknesses of symmetric ciphers.
- Identify the weaknesses with symmetric key encryption and why modern cryptography involves more complex mathematics
- Explain the difference between symmetric and asymmetric encryption
- Describe the key exchange process using the Diffie-Hellman algorithm (basic understanding).
- Explain how public-key cryptography is used for encryption and decryption.
- Define digital certificates and explain their role in web security.
- Describe the basic steps involved in the SSL/TLS handshake process.
- Explain the concept of hashing and its importance in data verification.
- Demonstrate their understanding of different cryptographic techniques by creating puzzles
- Develop a storyline and theme for their escape room, incorporating creativity and problem-solving skills
- Collaborate effectively to design and implement their escape room experience
- Provide and receive constructive feedback to improve their escape room design

Learning Activities & Differentiation: *(Amistad & Holocaust, Asian American & Pacific Islanders, Climate Change, LGBTQ and People with Disabilities, Diversity, Equity & Inclusion [DEI])*

Learning Activities:

- Cipher Decoding Stations: Students rotate through stations decoding Caesar, Vigenère, and transposition ciphers, with examples drawn from different historical contexts including WWII Navajo Code Talkers (Native American contributions) and Alan Turing's work in the Holocaust.
- Encryption in History & Culture: Analyze how cryptography has been used by resistance groups and marginalized communities (e.g., LGBTQ+ activists, civil rights leaders, political dissidents) to protect communication.
- Digital Trust and Identity: Students explore how public key encryption and digital certificates work by role-playing secure message exchanges and SSL/TLS handshakes, tying in scenarios about online safety for people with disabilities or LGBTQ+ identities.
- Cryptographic Puzzles Project: Students apply symmetric and asymmetric encryption by creating themed puzzles tied to social justice (e.g., escaping censorship, protecting journalists) and present them in a collaborative escape room format.
- Debate: Cryptography and Surveillance: Research and discuss the ethical implications of surveillance, government decryption mandates, and algorithmic bias with a focus on climate activists, immigrant populations, and racial profiling.

Differentiation Strategies:

- For Advanced Learners: Offer research projects on quantum cryptography, lead lessons on the Diffie-Hellman algorithm, or design multilayered encryption puzzles for the escape room project.
- For Struggling Learners: Provide guided cipher activities with visual aids, use step-by-step encryption diagrams, and break down technical vocabulary with graphic organizers.
- For English Language Learners: Include bilingual glossaries of cryptography terms, videos with subtitles, and visual cipher walkthroughs to support comprehension.
- Universal Design for Learning: Provide content through articles, videos, and hands-on activities; allow students to demonstrate learning through infographics, podcasts, or digital games; offer flexible deadlines and checkpoints for pacing.

Education Connections:

- Highlight diverse cryptographers and cybersecurity innovators including LGBTQ+ figures like Alan Turing and women pioneers in tech.
- Discuss how encryption protects the digital rights and safety of people with disabilities and LGBTQ+ individuals.
- Explore how historical and modern movements (e.g., civil rights, climate activism) use encryption to protect organizing and communication.
- Examine the impact of surveillance and algorithmic bias on marginalized communities and the role of cryptography in promoting digital justice.
- Encourage discussion on equity in access to privacy tools and ethical responsibility in designing secure systems.

Assessment Evidence

Formative Assessments:

- CodeHS exercises
    - Example Assignment: Rail Fence Cipher

      The Rail Fence Cipher is a form of transposition cipher that uses columns and rows. The plaintext is written downwards and bounces back and forth on a diagonal. The 'rails' refer to the number of rows. Decrypt the message below using 5 rails. Using the Rail Fence Cipher, encrypt your own message and trade with a partner. See if you can decrypt the message without knowing how many rails your partner used. How could you make this cipher even stronger?
    - Example Assignment: Public Key Encryption Exploration

      You would like to send a message to your friend. Your friend will need a private key as well to add to the encryption. Complete the chart according to the rules of the public key and the two private keys.
    - Example Assignment: Guess The Hash

      Work with a partner and take turns hiding a password, and trying to guess the password. Without letting your partner see, type in a simple word (about 3-7 letters long) as your password. You'll see the corresponding

hash in the output box. Using the scrambled letters, attempt to guess the password. You will only know if you have guessed the password if the hashes shown match.

- CodeHS Checks for Understanding

Summative Assessments:

- Unit Project: Create an Escape Room

Common Benchmark Assessments:

- Unit Project: Create an Escape Room

Alternative Assessments:

- CodeHS Unit Quiz

Core Instructional & Supplemental Materials

Core Materials:

- CodeHS Fundamentals of Cybersecurity – Module 2: Cryptography and Module 3: Escape Room Project
- CodeHS interactive lessons, quizzes, and encryption/decryption exercises on classical and modern cryptographic methods
- Hands-on cipher activities (Caesar, Vigenère, transposition) and simulations of public/private key encryption
- CodeHS cryptography vocabulary reference sheets and concept checks
- Public key infrastructure (PKI) and hashing tutorials with embedded practice tools
- Articles and video content covering the history of cryptography, modern encryption, and ethical implications
- Escape room design guidelines and templates integrated with cryptographic puzzle requirements

Supplemental Materials:

- Guided note-taking organizers for symmetric vs. asymmetric encryption, hash functions, and the SSL/TLS handshake
- Visuals and diagrams illustrating encryption algorithms, key exchanges, and authentication processes
- Historical cryptography case studies and context sheets (e.g., Enigma, Navajo Code Talkers, Alan Turing)
- Escape room planning documents including puzzle design templates, storyboarding tools, and testing checklists

- Peer feedback forms and reflection prompts for collaborative project work and iteration
- Graphic organizers and glossaries to support English Language Learners and students with diverse learning needs
- Rubrics for evaluating cipher decoding skills, encryption concept explanations, and final escape room projects
- Printable cipher wheels, letter frequency charts, and example ciphertexts for classroom decoding activities

Accommodations and Modifications: Students with Disabilities, English Language Learners, Students at Risk of Failure, Students with 504s, Gifted & Talented Students

Specific Strategies and Practices that Support Students with Disabilities:

Students receiving Special Education programming have specific goals and objectives, as well as accommodations and modifications outlined within their Individualized Education Plans (IEP) due to an identified disability and/or diagnosis. In addition to exposure to the general education curriculum, the instruction is differentiated based upon the student's needs. The IEP acts as a supplemental curriculum guide inclusive of instructional strategies that support each learner.

- Small group/One to one – Additional time – Review of directions – Student restates information – Extra visual and verbal cues and prompts – Verbal and visual cues regarding directions and staying on task – Checklists – Immediate feedback

Specific Strategies and Practices that Support English Language Learners

English language learner (ELL) is a national-origin-minority student who is limited-English-proficient. This term is often preferred over limited-English-proficient (LEP) as it highlights accomplishments rather than deficits.

- Pre-teaching of vocabulary and concepts – Personal Glossary – Extended Time – Simplified/Verbal Instructions – Visual learning, including graphic organizers – Teacher modeling – Pairing students with beginning English language skills with students who have more advanced English language skills – Scaffolding – Word walls – Think-pair-share – Cooperative learning groups

Students at Risk of Failure

- Alternative Assessments – Think-Pair-Share by Readiness – Differentiated Online Practice – Leveled Rubrics – Tiered Level of Supports – Tiered Activities – Small Group Instruction – Work Alone Choice – Group Work Choice

Students with 504 Plans

Teachers are responsible for implementing designated services and strategies identified on a student's 504 Plan.
504 plans are formal plans that schools develop to give kids the support they need and covers any condition that limits daily activities in a major way. Students' accommodations are outlined in their individual 504 plan.

Specific Strategies and Practices that Support Gifted & Talented Students
It is critical that all teachers are able to recognize a high-ability student who may need more depth and complexity in instruction.
-Small Group In-Depth Instruction – Differentiated Online Practice – Alternative Assessments

Unit 3

Desired Results

Unit 3 Title: System Administration

Unit Summary:

In this unit, students will compare and contrast common operating systems (Windows, Linux, OS) and explain the importance of application security. They will investigate security options and implement user accounts to enforce authentication and authorization. Students will also demonstrate how to work with basic and advanced command prompts.

Learning Standards

NJSLS:

- 8.1.12.CS.1: Describe ways in which integrated systems hide underlying implementation details to simplify user experiences.
- 8.1.12.CS.2: Model interactions between application software, system software, and hardware.
- 8.1.12.CS.3: Compare the functions of application software, system software, and hardware.
- 8.1.12.CS.4: Develop guidelines that convey systematic troubleshooting strategies that others can use to identify and fix errors.
- 8.1.12.NI.2: Evaluate security measures to address various common security threats.
- 8.1.12.NI.3: Explain how the needs of users and the sensitivity of data determine the level of security implemented.

- 8.1.12.NI.4: Explain how decisions on methods to protect data are influenced by whether the data is at rest, in transit, or in use.
- 8.1.12.IC.1: Evaluate the ways computing impacts personal, ethical, social, economic, and cultural practices.
- 8.1.12.AP.1: Design algorithms to solve computational problems using a combination of original and existing algorithms.
- 8.1.12.AP.3: Select and combine control structures for a specific application based upon performance and readability, and identify trade-offs to justify the choice.
- 8.1.12.AP.4: Design and iteratively develop computational artifacts for practical intent, personal expression, or to address a societal issue.
- 8.1.12.AP.5: Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects.
- 8.1.12.AP.6: Create artifacts by using procedures within a program, combinations of data and procedures, or independent but interrelated programs.
- 8.1.12.AP.7: Collaboratively design and develop programs and artifacts for broad audiences by incorporating feedback from users.
- 8.1.12.AP.8: Evaluate and refine computational artifacts to make them more usable and accessible.
- 8.1.12.AP.9: Collaboratively document and present design decisions in the development of complex programs.
- 8.2.12.ED.1: Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers.
- 8.2.12.ED.4: Design a product or system that addresses a global problem and document decisions made based on research, constraints, trade-offs, and aesthetic and ethical considerations and share this information with an appropriate audience.
- 8.2.12.ED.5: Evaluate the effectiveness of a product or system based on factors that are related to its requirements, specifications, and constraints (e.g., safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, ergonomics).
- 8.2.12.ITH.1: Analyze a product to determine the impact that economic, political, social, and/or cultural factors have had on its design, including its design constraints.
- 8.2.12.ITH.3: Analyze the impact that globalization, social media, and access to open source technologies has had

on innovation and on a society's economy, politics, and culture.

- 8.2.12.NT.1: Explain how different groups can contribute to the overall design of a product.
- 8.2.12.NT.2: Redesign an existing product to improve form or function.
- 8.2.12.ETW.1: Evaluate ethical considerations regarding the sustainability of environmental resources that are used for the design, creation, and maintenance of a chosen product.
- 8.2.12.EC.1: Analyze controversial technological issues and determine the degree to which individuals, businesses, and governments have an ethical role in decisions that are made.
- 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.

Interdisciplinary Connections

Career Readiness, Life Literacies, & Key Skills *(CLKS)*:

- 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).
- 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).
- 9.4.12.DC.1: Explain the beneficial and harmful effects that intellectual property laws can have on the creation and sharing of content (e.g., 6.1.12.CivicsPR.16.a).
- 9.4.12.DC.3: Evaluate the social and economic implications of privacy in the context of safety, law, or ethics (e.g., 6.3.12.HistoryCA.1).
- 9.4.12.DC.4: Explain the privacy concerns related to the collection of data (e.g., cookies) and generation of data through automated processes that may not be evident to users (e.g., 8.1.12.NI.3).
- 9.4.12.DC.5: Debate laws and regulations that impact the development and use of software.
- 9.4.12.DC.6: Select information to post online that positively impacts personal image and future college and career opportunities.
- 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task (e.g., W.11-12.6.).
- 9.4.12.TL.2: Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.
- 9.4.12.TL.3: Analyze the effectiveness of the process and quality of collaborative environments.

- 9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem (e.g., 7.1.AL.IPERS.6).

Interdisciplinary Connections:

Science and Engineering Practices:

- Develop a model based on evidence to illustrate the relationships between systems or between components of a system.
- Use a model to predict the relationships between systems or between components of a system.
- Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.
- Apply scientific ideas to solve a design problem, taking into account possible unanticipated effects.
- Communicate scientific and technical information (e.g. about the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically).
- Create a computational model or simulation of a phenomenon, designed device, process, or system.
- Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.
- Evaluate the claims, evidence, and reasoning behind currently accepted explanations or solutions to determine the merits of arguments.
- Use mathematical and/or computational representations of phenomena or design solutions to support explanations.
- Apply scientific reasoning to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion.
- Construct an oral and written argument or counter-arguments based on data and evidence.
- Design or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.

- Evaluate a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.

Engineering Design Standards:

- HS-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
- HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
- HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
- HS-ETS1-4 Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

Learning Targets

Unit Essential Questions:

- How do different operating systems (Windows, Linux, macOS) compare in terms of functionality, usability, and security?
- Why is application security critical for both users and organizations, and how can it be enforced at the system level?
- What are the benefits and risks of creating multiple user accounts with specific permissions on a shared device?

Unit Enduring Understandings:

- Operating systems differ in structure and features, but all manage hardware resources and provide a platform for application execution.
- Application security is essential to protect personal and organizational data, and it relies on user authentication, authorization, and system-level controls.
- Creating and managing user accounts with appropriate access levels helps protect system integrity and supports responsible digital behavior.

• In what ways can the command line interface be used to perform essential and advanced administrative tasks? • How does configuring system settings and permissions influence the overall security and usability of a computer system?	• The command line interface is a powerful tool that enables system administrators to perform tasks efficiently and with greater control than graphical interfaces. • Effective system administration requires understanding the relationship between user needs, system configurations, and security best practices.
Vocabulary: operating system, software, security, authentication, authorization, user account, permissions, directory, command line, linux, windows, macos, firewall, encryption, admin rights, root, shell, license, patch, sudo	
Students will be able to: • Explain the purpose of operating systems • Identify the main types of operating systems • Analyze the upgrade and installation process for operating systems • Identify their computer's operating system • Explore and configure basic display, sound, and storage settings • Troubleshoot minor configuration issues • Identify resources for finding additional information about their system • Compare and contrast the interface of Mac, Windows, and Linux operating systems • Explain how operating systems use file systems to manage data • Compare and contrast file systems of different operating systems • Explain the role of the processor in a computer system • Explain the difference between a 32-bit and 64-bit processor and the impact it has on the operating system • Identify key differences between laptops and tablets • Analyze the strengths and weaknesses of each device type • Explain the different types of software (productivity, collaboration, business) and the purpose of each. • Explain the benefits and challenges of single and cross-platform software.	

- Explain the different types of software licenses
- Explain the different delivery methods and architecture models of installing software
- Explain the importance of application security
- Explain the multiple methods for protecting software
- Configure their browser to enhance security and privacy
- Explain how the following features impact their browser security: cache, client-side scripting, browser extensions, private browsing, proxy settings, certificates, and popup blockers
- Describe appropriate browser security configurations
- Describe how creating user accounts and permissions enhances security
- Define system hardening explain the importance of establishing baseline security, including deciding rules around authentication and authorization
- Explain the importance of performing security audits
- Understand the connection between a command line (CLI) interface and a graphical line interface (GUI)
- Use the appropriate command line tool for different tasks
- Practice basic navigation commands in the CLI

Learning Activities & Differentiation: *(Amistad & Holocaust, Asian American & Pacific Islanders, Climate Change, LGBTQ and People with Disabilities, Diversity, Equity & Inclusion [DEI])*

Learning Activities:

- Interactive OS Labs: Hands-on comparison of macOS, Windows, and Linux through virtual machines or sandbox environments.
- Command Line Skill Builders: Students practice navigation, file management, and user account commands via the CLI in both Windows and Linux.
- Security Scenarios: Students work in teams to analyze real-world case studies involving breaches due to poor system configuration or lack of application security.
- User Account Simulation: Simulate managing a shared device where students assign, configure, and test user permissions based on given user profiles (e.g., admin, guest, standard).

- System Hardening Challenge: Students apply baseline security measures (e.g., firewall, encryption, updates, secure browser configuration) to a mock system and explain their rationale.
- Cultural Connections Research Project: Students research how access to technology varies across communities and present how operating systems and open-source platforms like Linux have helped close (or widen) the digital divide.
- Inclusive Design Discussion: Students evaluate how system administration practices (such as assistive tech and user permissions) can support users with disabilities and promote inclusive computing environments.

Differentiation Strategies:

- Advanced Learners: Create shell scripts to automate admin tasks, compare security models of Linux and Windows, or teach a mini-lesson on file system permissions to peers.
- Struggling Learners: Follow step-by-step video walkthroughs for command line practice, complete simplified OS comparison charts, or work with a peer tutor during hands-on labs.
- English Language Learners: Use translated command line cheat sheets, label annotated screenshots with native language terms, or build a personal bilingual glossary of system terms.
- Universal Design for Learning (UDL): Choose between visual infographics, recorded video walkthroughs, or written reports for projects; work at an individual pace through tiered activities; or use screen readers and keyboard navigation tools during system configuration tasks.

Education Connections:

- Highlight diverse voices and contributions in operating system development and cybersecurity, including innovators from historically underrepresented communities in technology.
- Discuss how user permissions, assistive technologies, and secure system configurations promote digital accessibility and safety for people with disabilities and LGBTQ+ individuals.
- Explore ethical responsibilities in system administration through historical and social justice lenses, including the protection of sensitive data and the importance of preserving digital records.
- Examine disparities in access to secure and up-to-date technology infrastructure across different communities,

emphasizing the need for equity in digital tools, system resources, and administrative support.

Assessment Evidence

Formative Assessments:

- CodeHS exercises
    - Example Assignment: Do I Need a Software License?

      You have built a new picture-taking app complete with new original filters for iOS phones and you are excited to start selling it in the app store! Brainstorm and create a software agreement for your new app.
    - Example Assignment: Directory Directions

      You are teaching your friend how to use the command line interface. He has listed his steps and would like to know what he should type in the CLI for each one. Can you help him out?
- CodeHS Checks for Understanding

Summative Assessments:

- Lab: Configuring a Computer
- Lab: Navigating with the CLI

Common Benchmark Assessments:

- Lab: Configuring a Computer
- Lab: Navigating with the CLI

Alternative Assessments:

- CodeHS Unit Quiz

Core Instructional & Supplemental Materials

Core Materials:

- CodeHS Fundamentals of Cybersecurity – Module 4: System Administration and Operating Systems

- CodeHS interactive lessons, quizzes, and virtual labs on Windows, Linux, and macOS environments
- Hands-on command line activities and simulations (e.g., creating user accounts, navigating file systems, configuring security settings)
- Tutorials on application security, user permissions, and system hardening with embedded practice tasks
- Guided browser security labs focusing on privacy settings, extensions, and secure configurations
- Video content and articles explaining the history and structure of operating systems, ethical use of admin rights, and accessibility considerations
- System configuration tasks in sandboxed environments, with progress tracking and automatic feedback
- CodeHS vocabulary reference sheets and checkpoints for operating systems, CLI tools, and security practices

Supplemental Materials:

- Guided note-taking organizers for comparing operating systems, understanding file systems, and documenting CLI commands
- Diagrams illustrating operating system architecture, command structures, and user access levels
- Case studies and discussion prompts on real-world system security breaches and misconfigurations
- Interactive OS comparison charts and permission mapping worksheets to support conceptual understanding
- Templates for documenting system hardening procedures and user role definitions
- Graphic organizers, glossaries, and sentence frames to support English Language Learners and students with diverse needs
- Rubrics for assessing command line proficiency, system configuration explanations, and application of security best practices
- Printable quick-reference sheets for Linux and Windows CLI commands, user management tools, and browser security settings

Accommodations and Modifications: Students with Disabilities, English Language Learners, Students at Risk of Failure, Students with 504s, Gifted & Talented Students

Specific Strategies and Practices that Support Students with Disabilities:

Students receiving Special Education programming have specific goals and objectives, as well as accommodations and modifications outlined within their Individualized Education Plans (IEP) due to an identified disability and/or diagnosis. In addition to exposure to the general education curriculum, the instruction is differentiated based upon the student's needs. The IEP acts as a supplemental curriculum guide inclusive of instructional strategies that support each learner.

- Small group/One-to-one support – Extra visual and verbal cues – Checklists – Immediate feedback

Specific Strategies and Practices that Support English Language Learners

English language learner (ELL) is a national-origin-minority student who is limited-English-proficient. This term is often preferred over limited-English-proficient (LEP) as it highlights accomplishments rather than deficits.

- Pre-teaching of vocabulary – Personal Glossary – Simplified/Verbal Instructions – Visual learning, including graphic organizers – Teacher modeling – Scaffolding

Students at Risk of Failure

- Alternative Assessments – Differentiated Online Practice – Tiered Activities – Small Group Instruction – Group Work Choice

Students with 504 Plans

Teachers are responsible for implementing designated services and strategies identified on a student's 504 Plan.
504 plans are formal plans that schools develop to give kids the support they need and covers any condition that limits daily activities in a major way. Students' accommodations are outlined in their individual 504 plan.

Specific Strategies and Practices that Support Gifted & Talented Students

It is critical that all teachers are able to recognize a high-ability student who may need more depth and complexity in instruction.

-Small Group In-Depth Instruction – Differentiated Online Practice – Alternative Assessments

Unit 4

Desired Results

Unit 4 Title: IT Concepts

Unit Summary:

In this unit, students explore the structure and design of the internet and networks, and how this design affects the reliability of network communication, the security of data, and personal privacy. Students will learn how the Internet connects computers all over the world by use of networking protocols.

Learning Standards

NJSLS:

- 8.1.12.CS.2: Model interactions between application software, system software, and hardware.
- 8.1.12.CS.3: Compare the functions of application software, system software, and hardware.
- 8.1.12.CS.4: Develop guidelines that convey systematic troubleshooting strategies that others can use to identify and fix errors.
- 8.1.12.NI.1: Evaluate the scalability and reliability of networks, by describing the relationship between routers, switches, servers, topology, and addressing.
- 8.1.12.NI.2: Evaluate security measures to address various common security threats.
- 8.1.12.NI.3: Explain how the needs of users and the sensitivity of data determine the level of security implemented.
- 8.1.12.NI.4: Explain how decisions on methods to protect data are influenced by whether the data is at rest, in transit, or in use.
- 8.1.12.IC.1: Evaluate the ways computing impacts personal, ethical, social, economic, and cultural practices.
- 8.1.12.IC.3: Predict the potential impacts and implications of emerging technologies on larger social, economic, and political structures, using evidence from credible sources.
- 8.1.12.DA.3: Translate between decimal numbers and binary numbers.
- 8.1.12.DA.4: Explain the relationship between binary numbers and the storage and use of data in a computing device.

Interdisciplinary Connections

Career Readiness, Life Literacies, & Key Skills *(CLKS)*:

- 9.4.12.DC.3: Evaluate the social and economic implications of privacy in the context of safety, law, or ethics (e.g., 6.3.12.HistoryCA.1).

- 9.4.12.DC.4: Explain the privacy concerns related to the collection of data (e.g., cookies) and generation of data through automated processes that may not be evident to users (e.g., 8.1.12.NI.3).
- 9.4.12.DC.5: Debate laws and regulations that impact the development and use of software.
- 9.4.12.DC.6: Select information to post online that positively impacts personal image and future college and career opportunities.
- 9.4.12.DC.7: Evaluate the influence of digital communities on the nature, content and responsibilities of careers, and other aspects of society (e.g., 6.1.12.CivicsPD.16.a).
- 9.4.12.IML.2: Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources (e.g., NJSLSA.W8, SocialStudies Practice: Gathering and Evaluating Sources.
- 9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.IH.IPRET.8).
- 9.4.12.IML.4: Assess and critique the appropriateness and impact of existing data visualizations for an intended audience (e.g., S-ID.B.6b, HS-LS2-4).
- 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task (e.g., W.11-12.6.).
- 9.4.12.TL.3: Analyze the effectiveness of the process and quality of collaborative environments.

Interdisciplinary Connections:

Science and Engineering Practices:

- Develop a model based on evidence to illustrate the relationships between systems or between components of a system.
- Use a model to predict the relationships between systems or between components of a system.
- Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.
- Apply scientific ideas to solve a design problem, taking into account possible unanticipated effects.

- Communicate scientific and technical information (e.g. about the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically).
- Create a computational model or simulation of a phenomenon, designed device, process, or system.
- Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.
- Evaluate the claims, evidence, and reasoning behind currently accepted explanations or solutions to determine the merits of arguments.
- Use mathematical and/or computational representations of phenomena or design solutions to support explanations.
- Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible.
- Evaluate evidence behind currently accepted explanations or solutions to determine the merits of arguments.
- Construct an oral and written argument or counter-arguments based on data and evidence.
- Evaluate a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.

Engineering Design Standards:

- HS-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
- HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
- HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

- HS-ETS1-4 Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

Learning Targets

Unit Essential Questions:

- How does the structure and design of the Internet influence the reliability and speed of communication?
- Why are networking protocols like TCP, UDP, and HTTP crucial for data transmission?
- In what ways does the Internet affect personal privacy and data security?
- How does understanding binary and encoding help us communicate information digitally?
- What impact does the Internet have on individuals, communities, and global society?

Unit Enduring Understandings:

- The Internet is a global system of interconnected networks that relies on standardized protocols to ensure reliable and efficient communication.
- Protocols such as TCP/IP, HTTP/HTTPS, and UDP govern how data is packaged, transmitted, and received across the Internet.
- Understanding the OSI Model helps troubleshoot network issues by identifying the specific layer where a problem occurs.
- All digital data, including text and images, is represented and transmitted using binary encoding.
- While the Internet provides countless benefits, it also raises important concerns about privacy, security, and the ethical use of information.

Vocabulary: binary, encoding, ip address, packet, routing, tcp, udp, http, https, protocol, osi model, network, internet, security, privacy

Students will be able to:

- Explain the significance of binary in computer communication
- Encode and decode messages using binary representation
- Understand the role of transistors in storing and processing binary information

- Explain how text can be represented using a sequence of 0s and 1s (binary code)
- Convert between binary and decimal numbers
- Identify binary place values
- Encode and decode messages using ASCII
- Apply binary concepts to real-world scenarios
- Understand how images can be encoded as data
- Create pixel images in color and black and white
- Identify bit storage units by name and size
- Define what the internet is and explain its significance
- Differentiate between wired and wireless networks
- Understand the role of submarine cables in global connectivity
- Reflect on the foundational concepts of the internet as described by Vint Cerf
- Articulate their understanding of the internet through open-ended responses
- Evaluate protocol effectiveness
- Demonstrate an understanding of IP addresses
- Identify IP addresses of devices in a simulated environment
- Discuss privacy concerns related to IP addresses
- Explain how computers communicate using routers, and explain what considerations are made when choosing a route
- Map messages across several routers of different statuses
- Analyze the transmission of data between IP addresses using packets
- Determine if TCP or UDP protocols are more appropriate for transferring several types of data
- Understand the structure of a website and its components
- Explain how web pages are stored and delivered using web servers and protocols
- Demonstrate the process of sending and receiving data over the internet through activities
- Identify the seven layers of the OSI Model
- Explain the purpose and function of each layer

- Analyze real-world networking issues using the OSI Model framework
- Describe the various impacts of the internet on social, educational, and personal life
- Express their feelings about the internet using the Compass Points thinking routine
- Conduct research on selected internet topics
- Demonstrate an understanding of properly citing sources
- Participate in discussions, comparing perspectives with peers

Learning Activities & Differentiation: *(Amistad & Holocaust, Asian American & Pacific Islanders, Climate Change, LGBTQ and People with Disabilities, Diversity, Equity & Inclusion [DEI])*

Learning Activities:

- Binary Communication Games: Students simulate computer communication by encoding and decoding binary messages using ASCII, reinforcing concepts of representation and reliability in digital communication.
- Internet Mapping Activity: Students visualize the global structure of the internet by mapping undersea cables and identifying their impact on connectivity and access.
- Routing Simulation: Students act as routers passing packets across a physical classroom "network," making decisions about path reliability and delays.
- OSI Model Case Study: Students use real-world networking scenarios to analyze which OSI layer is responsible for an issue and propose solutions.
- Protocol Relay Race: Students role-play as TCP and UDP in a relay activity, demonstrating reliable vs. fast delivery of information.

Differentiation Strategies:

- Advanced Learners: Create animations or visual explainers of the OSI model, compare TCP and UDP through packet analysis tools, or develop a mini-website explaining a networking concept using HTML/CSS.
- Struggling Learners: Use guided graphic organizers for the OSI model, complete fill-in-the-blank protocol charts, or participate in teacher-facilitated small group binary practice.
- English Language Learners (ELLs): Use bilingual vocabulary flashcards for terms like “protocol” and “packet,” work

with translated diagrams of the OSI model, or watch subtitled videos explaining IP routing.
- Universal Design for Learning (UDL): Choose from drawing diagrams, creating short videos, or writing responses to demonstrate understanding of how the internet works; use screen readers or closed captions during digital instruction; offer tactile binary encoding activities with physical cards or tiles.

Education Connections:
- Highlight the contributions of diverse technologists like Vint Cerf (deaf technologist and one of the "fathers of the internet"), Radia Perlman (networking pioneer), and leaders from historically underrepresented communities in tech.
- Explore ethical and privacy issues such as surveillance, censorship, and digital inequality through historical parallels (e.g., controlling communication in oppressive regimes) and current events.
- Discuss global disparities in access to reliable internet and how these affect education, employment, and civic participation—especially in underserved or marginalized communities.
- Examine how digital networks can support inclusive practices, such as accessible web design, secure digital identity, and protocols that support universal access to information.

Assessment Evidence

Formative Assessments:
- CodeHS exercises
    - Example Assignment: Write a Message in Binary

      In this activity, you will use ASCII encoding to write the same message in binary. Then, you will trade messages with a partner and use ASCII encoding to figure out your partner's message.
    - Example Assignment: Troubleshooting with the OSI Model

      You have been hired as a network engineer for Tea-Riffic Blends Co., a small business that sells specialty teas. You are in charge of setting up their network, configuring it, and solving any issues that arise. The OSI model can help with troubleshooting because it can isolate the layer causing the issue. Read through the

following three scenarios. Based on the problem and what you know about the OSI layers, identify which layer you should target to solve the issue. Then, explain your reasoning.

- CodeHS Checks for Understanding

Summative Assessments:

- Compass Points: The Internet

  In this activity, students use the Compass Points thinking routine to examine their feelings about the Internet and its impact on society.

Common Benchmark Assessments:

- Compass Points: The Internet

  In this activity, students use the Compass Points thinking routine to examine their feelings about the Internet and its impact on society.

Alternative Assessments:

- CodeHS Unit Quiz

Core Instructional & Supplemental Materials

Core Materials:

- CodeHS Fundamentals of Cybersecurity – Module 5: IT Concepts
- CodeHS interactive lessons, quizzes, and virtual activities covering binary, IP addresses, routing, protocols (TCP, UDP, HTTP/HTTPS), and the OSI model
- Hands-on simulations and labs on encoding text and images, routing messages, and analyzing data transmission
- Interactive protocol demos for comparing TCP and UDP performance in different use cases
- OSI Model troubleshooting scenarios where students diagnose and resolve network issues layer by layer
- Web-based activities demonstrating how websites work, including domain name resolution, HTTP requests, and server responses

- Video content and readings on internet infrastructure, the role of undersea cables, IP addressing, and the historical development of the internet
- Compass Points and reflection routines for exploring the personal, social, and global impacts of the internet
- Built-in CodeHS vocabulary lists and checkpoints for binary, networking protocols, IP addresses, and OSI model layers

Supplemental Materials:

- Guided graphic organizers for binary place values, IP addressing, protocol comparisons, and OSI layer functions
- Network diagrams and flowcharts illustrating data flow through routers, packets, and protocol stacks
- ASCII charts and binary reference tables for encoding and decoding text
- Case studies and discussion prompts exploring privacy concerns, data routing decisions, and access equity in digital infrastructure
- Interactive worksheets on packet path mapping, protocol effectiveness, and IP address identification
- Templates for protocol evaluation, OSI model analysis, and internet impact reflection
- Glossaries, visual aids, and sentence starters to support English Language Learners and students with diverse language or learning needs
- Rubrics for assessing binary communication tasks, protocol comparisons, network issue analysis, and reflective writing on internet use and impact
- Printable quick-reference sheets for IP addressing rules, protocol definitions, OSI model layers, and common networking tools

Accommodations and Modifications: Students with Disabilities, English Language Learners, Students at Risk of Failure, Students with 504s, Gifted & Talented Students

Specific Strategies and Practices that Support Students with Disabilities:

Students receiving Special Education programming have specific goals and objectives, as well as accommodations and modifications outlined within their Individualized Education Plans (IEP) due to an identified disability and/or diagnosis. In addition to exposure to the general education curriculum, the instruction is differentiated based upon the student's needs. The IEP acts as a supplemental curriculum guide inclusive of instructional strategies that support each learner.

- Additional time – Review of directions – Student restates information – Extra visual and verbal cues and prompts – Verbal and visual cues regarding directions and staying on task – Checklists – Immediate feedback

Specific Strategies and Practices that Support English Language Learners

English language learner (ELL) is a national-origin-minority student who is limited-English-proficient. This term is often preferred over limited-English-proficient (LEP) as it highlights accomplishments rather than deficits.

- Personal Glossary – Simplified/Verbal Instructions – Visual learning, including graphic organizers – Teacher modeling – Scaffolding – Word walls – Think-pair-share – Cooperative learning groups

Students at Risk of Failure

- Home/School Connection – Alternative Assessments – Think-Pair-Share by Readiness – Differentiated Online Practice – Leveled Rubrics – Tiered Activities – Small Group Instruction – Work Alone Choice – Group Work Choice

Students with 504 Plans

Teachers are responsible for implementing designated services and strategies identified on a student's 504 Plan.
504 plans are formal plans that schools develop to give kids the support they need and covers any condition that limits daily activities in a major way. Students' accommodations are outlined in their individual 504 plan.

Specific Strategies and Practices that Support Gifted & Talented Students

It is critical that all teachers are able to recognize a high-ability student who may need more depth and complexity in instruction.

-Differentiated Online Practice – Alternative Assessments – Pre-Assess to provide Differentiated Instruction to Accelerate Learning

Unit 5

Desired Results

Unit 5 Title: IT Infrastructure

Unit Summary:

In this unit, students will learn about the physical elements of computers and networking such as motherboards, RAM, routers, and the use of port numbers, ethernet, and wireless devices. Students will also explore cybersecurity career pathways and build skills that will be needed within these fields such as communication. Students will explore the troubleshooting methodology and utilize it to solve sample IT support issues.

Learning Standards

NJSLS:

- 8.1.12.CS.1: Describe ways in which integrated systems hide underlying implementation details to simplify user experiences.
- 8.1.12.CS.2: Model interactions between application software, system software, and hardware.
- 8.1.12.CS.3: Compare the functions of application software, system software, and hardware.
- 8.1.12.CS.4: Develop guidelines that convey systematic troubleshooting strategies that others can use to identify and fix errors.
- 8.1.12.NI.1: Evaluate the scalability and reliability of networks, by describing the relationship between routers, switches, servers, topology, and addressing.
- 8.1.12.NI.2: Evaluate security measures to address various common security threats.
- 8.1.12.NI.3: Explain how the needs of users and the sensitivity of data determine the level of security implemented.
- 8.1.12.NI.4: Explain how decisions on methods to protect data are influenced by whether the data is at rest, in transit, or in use.

Interdisciplinary Connections

Career Readiness, Life Literacies, & Key Skills *(CLKS)*:

- 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).
- 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).
- 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).

- 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.
- 9.4.12.DC.1: Explain the beneficial and harmful effects that intellectual property laws can have on the creation and sharing of content (e.g., 6.1.12.CivicsPR.16.a).
- 9.4.12.DC.3: Evaluate the social and economic implications of privacy in the context of safety, law, or ethics (e.g., 6.3.12.HistoryCA.1).
- 9.4.12.DC.4: Explain the privacy concerns related to the collection of data (e.g., cookies) and generation of data through automated processes that may not be evident to users (e.g., 8.1.12.NI.3).
- 9.4.12.DC.5: Debate laws and regulations that impact the development and use of software.
- 9.4.12.DC.6: Select information to post online that positively impacts personal image and future college and career opportunities.
- 9.4.12.DC.7: Evaluate the influence of digital communities on the nature, content and responsibilities of careers, and other aspects of society (e.g., 6.1.12.CivicsPD.16.a).
- 9.4.12.IML.2: Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources (e.g., NJSLSA.W8, SocialStudies Practice: Gathering and Evaluating Sources.
- 9.4.12.IML.7: Develop an argument to support a claim regarding a current workplace or societal/ethical issue such as climate change (e.g., NJSLSA.W1, 7.1.AL.PRSNT.4).
- 9.4.12.TL.3: Analyze the effectiveness of the process and quality of collaborative environments.
- 9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem (e.g., 7.1.AL.IPERS.6).

Interdisciplinary Connections:

Science and Engineering Practices:

- Develop a model based on evidence to illustrate the relationships between systems or between components of a system.
- Use a model to predict the relationships between systems or between components of a system.

- Apply scientific principles and evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.
- Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.
- Communicate scientific and technical information (e.g. about the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically).
- Create a computational model or simulation of a phenomenon, designed device, process, or system.
- Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.
- Apply scientific reasoning to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion.
- Construct an oral and written argument or counter-arguments based on data and evidence.
- Evaluate a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.

Engineering Design Standards:

- HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
- HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
- HS-ETS1-4 Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

Learning Targets

Unit Essential Questions:	**Unit Enduring Understandings:**
• How do the internal and external components of a computer system work together to process and transmit data? • What roles do network devices and communication protocols play in creating and managing a functional network? • How can we identify and solve common IT issues using a structured troubleshooting methodology? • What skills are essential for working in IT support and cybersecurity careers, and how can they be developed? • Why is clear communication and documentation critical in resolving technical problems and supporting users?	• Computer systems are composed of interdependent internal and peripheral components that work together to perform essential computing tasks. • Effective networking relies on both physical infrastructure and logical organization, including routers, switches, port numbers, and wireless access points. • The troubleshooting process is a systematic and repeatable method that helps IT professionals diagnose and solve technical problems. • Cybersecurity and IT support careers require strong technical knowledge, problem-solving abilities, and effective interpersonal communication. • Good customer service, clear instructions, and well-documented solutions are key to maintaining efficient and secure IT environments.
Vocabulary: motherboard, ram, cpu, router, switch, port number, ethernet, wireless, network, peripheral, storage, ssh, troubleshooting, protocol, device driver, ip address, bandwidth, latency, access point, firewall	
Students will be able to: • Explain the purpose of common internal computing components such as motherboards, BIOS, RAM, and more. • Identify and use appropriate tools for computer disassembly • Follow safety procedures to prevent damage to the computer or injury to oneself • Understand the components of a computer and their functions, including the motherboard, CPU, RAM, storage devices, and power supply • Disassemble a computer systematically, removing components in the correct order and storing them safely	

- Identify and troubleshoot potential issues during the disassembly process
- Explain the purposes and uses of various peripheral types
- Classify common types of input/output device interfaces.
- Explain how to install common peripheral devices to a laptop/PC
- Compare and contrast storage types
- Examine and discuss the security of cloud storage
- Select suitable storage devices for given situations
- Compare and contrast common Internet service types
- Compare and contrast common networking hardware devices
- Explain basic cable types, features, and their purposes
- Define and explain the function of a distribution frame (MDF) and its role in a network
- Design a distribution frame layout for a classroom or house, including connections for devices like routers, computers, and internet lines
- Identify and explain the purpose of cable management tools like patch panels and cable trays
- Describe the importance of power management in a network and the function of an uninterruptible power supply (UPS)
- Create a labeled diagram or model of a distribution frame system, including devices, ports, circuits, and cables, for future reference or troubleshooting
- Compare and contrast the different wireless network standards
- Compare and contrast Internet connection types, network types, and their features
- Locate and identify your computer's operating system and printer model
- Access printer settings and understand basic options like duplexing (printing on both sides)
- Utilize duplex printing for a multi-page document and troubleshoot if necessary
- Explain the benefits of duplex printing and collating (arranging pages in order)
- Adjust printer settings for collation and paper orientation (portrait/landscape) based on document needs
- Identify a mobile device model and access its settings
- Connect and manage Wi-Fi connections, understanding the difference between Wi-Fi and cellular data

- Pair and manage Bluetooth devices, explaining scenarios for customizing settings
- Research and explain mobile network technologies (CDMA, GSM, LTE, 5G)
- Explore email settings and protocols (POP3, IMAP, SMTP, MIME)
- Compare and contrast different ports, protocols and their purposes
- Explain the purpose of a firewall and how it protects against unwanted traffic
- Explain and use appropriate network command line tools
- Read and understand the basics of log reports
- Explore skill sets and duties of multiple cybersecurity careers
- Describe the skills involved in successful customer support
- Utilize customer support and communication skills in a mock customer support call
- Identify and articulate the steps involved in the troubleshooting process
- Effectively communicate technical issues and solutions in a clear and concise manner
- Develop and test hypotheses to resolve IT issues
- Document the troubleshooting process and its outcome in a professional manner
- Explain the purpose of a knowledge base and describe the characteristics of an effective knowledge base article
- Effectively provide instructions for how to troubleshoot a common network issue

Learning Activities & Differentiation: *(Amistad & Holocaust, Asian American & Pacific Islanders, Climate Change, LGBTQ and People with Disabilities, Diversity, Equity & Inclusion [DEI])*

Learning Activities:

- Binary Communication Games: Students simulate computer communication by encoding and decoding binary messages using ASCII, reinforcing concepts of representation and reliability in digital communication.
- Internet Mapping Activity: Students visualize the global structure of the internet by mapping undersea cables and identifying their impact on connectivity and access.
- Routing Simulation: Students act as routers passing packets across a physical classroom "network," making decisions about path reliability and delays.
- OSI Model Case Study: Students use real-world networking scenarios to analyze which OSI layer is responsible for

an issue and propose solutions.
- Protocol Relay Race: Students role-play as TCP and UDP in a relay activity, demonstrating reliable vs. fast delivery of information.

Differentiation Strategies:
- Advanced Learners: Create animations or visual explainers of the OSI model, compare TCP and UDP through packet analysis tools, or develop a mini-website explaining a networking concept using HTML/CSS.
- Struggling Learners: Use guided graphic organizers for the OSI model, complete fill-in-the-blank protocol charts, or participate in teacher-facilitated small group binary practice.
- English Language Learners (ELLs): Use bilingual vocabulary flashcards for terms like “protocol” and “packet,” work with translated diagrams of the OSI model, or watch subtitled videos explaining IP routing.
- Universal Design for Learning (UDL): Choose from drawing diagrams, creating short videos, or writing responses to demonstrate understanding of how the internet works; use screen readers or closed captions during digital instruction; offer tactile binary encoding activities with physical cards or tiles.

Education Connections:
- Highlight the contributions of diverse technologists like Vint Cerf (deaf technologist and one of the "fathers of the internet"), Radia Perlman (networking pioneer), and leaders from historically underrepresented communities in tech.
- Explore ethical and privacy issues such as surveillance, censorship, and digital inequality through historical parallels (e.g., controlling communication in oppressive regimes) and current events.
- Discuss global disparities in access to reliable internet and how these affect education, employment, and civic participation—especially in underserved or marginalized communities.
- Examine how digital networks can support inclusive practices, such as accessible web design, secure digital identity, and protocols that support universal access to information.

Assessment Evidence

Formative Assessments:

- CodeHS exercises
  - Example Assignment: Network Troubleshooting

    Jamal's computer is able to connect to the Wi-Fi signal, but there is no Internet access. Which device do you think might be causing the problem and why?
  - Example Assignment: Wireless Network Setup

    In this activity, students will draw a diagram that represents a wireless network setup that will be implemented for a fictitious house, office, or apartment building. The teacher will either assign them a building or they can create one from their own imagination.
- CodeHS Checks for Understanding

Summative Assessments:

- Lab: Computer Disassembly
- Lab: Design a Distribution Frame
- Lab: SOHO Devices
- Lab: Mobile Device Connectivity

Common Benchmark Assessments:

- Lab: Computer Disassembly
- Lab: Design a Distribution Frame
- Lab: SOHO Devices
- Lab: Mobile Device Connectivity

Alternative Assessments:

- CodeHS Unit Quiz

Core Instructional & Supplemental Materials

Core Materials:

- CodeHS Fundamentals of Cybersecurity – Module 6: IT Infrastructure & Module 7: Project: IT Professional
- CodeHS interactive lessons, quizzes, and virtual activities covering internal components, peripheral devices, networking hardware, wireless and wired communication, and power management systems
- Hands-on labs and simulations for computer disassembly, wireless network design, distribution frame setup, and identifying troubleshooting issues
- Interactive activities on port numbers, cabling, Wi-Fi configuration, and device connectivity to reinforce real-world infrastructure knowledge
- Troubleshooting practice scenarios using the structured methodology (identify, test, implement, document) applied to common IT support cases
- Video content and readings exploring internal hardware, storage types, cloud storage security, mobile networks (GSM, LTE, 5G), and cybersecurity career paths
- Scripted customer support role-play and tutorial video creation to build technical communication and service skills
- Built-in CodeHS vocabulary lists and checkpoints for computing hardware, network tools, troubleshooting terms, and mobile device settings

Supplemental Materials:

- Labeled diagrams and visual guides for computer components, peripheral connections, and networking hardware
- Graphic organizers and comparison charts for storage types, internet connection methods, and wireless standards
- Templates for disassembly procedures, troubleshooting logs, and knowledge base (KB) articles
- Practice worksheets on printer settings, device pairing, and IP configuration
- Case studies and discussion prompts focused on network failures, mobile device issues, and equitable access to infrastructure
- Sentence frames, glossaries, and annotated diagrams to support English Language Learners and diverse learners
- Rubrics for evaluating disassembly techniques, troubleshooting process documentation, and technical communication effectiveness

- Printable quick-reference sheets for port types, network command line tools, firewall basics, and mobile device settings

Accommodations and Modifications: Students with Disabilities, English Language Learners, Students at Risk of Failure, Students with 504s, Gifted & Talented Students

Specific Strategies and Practices that Support Students with Disabilities:
Students receiving Special Education programming have specific goals and objectives, as well as accommodations and modifications outlined within their Individualized Education Plans (IEP) due to an identified disability and/or diagnosis. In addition to exposure to the general education curriculum, the instruction is differentiated based upon the student's needs. The IEP acts as a supplemental curriculum guide inclusive of instructional strategies that support each learner.

- Small group/One to one – Review of directions – Student restates information – Extra visual and verbal cues and prompts – Verbal and visual cues regarding directions and staying on task – Checklists – Immediate feedback

Specific Strategies and Practices that Support English Language Learners
English language learner (ELL) is a national-origin-minority student who is limited-English-proficient. This term is often preferred over limited-English-proficient (LEP) as it highlights accomplishments rather than deficits.

- Pre-teaching of vocabulary and concepts – Personal Glossary – Simplified/Verbal Instructions – Visual learning, including graphic organizers – Teacher modeling – Scaffolding – Word walls – Think-pair-share – Cooperative learning groups

Students at Risk of Failure

- Home/School Connection – Alternative Assessments – Think-Pair-Share by Readiness – Differentiated Online Practice – Leveled Rubrics – Tiered Activities – Small Group Instruction – Work Alone Choice – Group Work Choice

Students with 504 Plans

Teachers are responsible for implementing designated services and strategies identified on a student's 504 Plan.
504 plans are formal plans that schools develop to give kids the support they need and covers any condition that limits daily activities in a major way. Students' accommodations are outlined in their individual 504 plan.

Specific Strategies and Practices that Support Gifted & Talented Students
It is critical that all teachers are able to recognize a high-ability student who may need more depth and complexity in instruction.
-Alternative Assessments – Pre-Assess to provide Differentiated Instruction to Accelerate Learning

Unit 6

Desired Results

Unit 6 Title: Data Security

Unit Summary:

In this unit, students will learn about the benefits and dangers of collecting and storing large sets of data. They will learn how to prevent attacks such as SQLi and XSS using programming controls. Students will also learn about risk management and how to identify, assess, prioritize, and minimize risks.

Learning Standards

NJSLS:

- 8.1.12.CS.4: Develop guidelines that convey systematic troubleshooting strategies that others can use to identify and fix errors.
- 8.1.12.NI.2: Evaluate security measures to address various common security threats.
- 8.1.12.NI.3: Explain how the needs of users and the sensitivity of data determine the level of security implemented.
- 8.1.12.NI.4: Explain how decisions on methods to protect data are influenced by whether the data is at rest, in transit, or in use.
- 8.1.12.IC.1: Evaluate the ways computing impacts personal, ethical, social, economic, and cultural practices.

- 8.1.12.AP.4: Design and iteratively develop computational artifacts for practical intent, personal expression, or to address a societal issue.
- 8.1.12.AP.5: Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects.
- 8.1.12.AP.7: Collaboratively design and develop programs and artifacts for broad audiences by incorporating feedback from users.

Interdisciplinary Connections

Career Readiness, Life Literacies, & Key Skills *(CLKS)*:

- 9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
- 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).
- 9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition (e.g., 2.1.12.PGD.1).
- 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).
- 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).
- 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).
- 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.
- 9.4.12.DC.1: Explain the beneficial and harmful effects that intellectual property laws can have on the creation and sharing of content (e.g., 6.1.12.CivicsPR.16.a).
- 9.4.12.DC.2: Compare and contrast international differences in copyright laws and ethics.
- 9.4.12.DC.3: Evaluate the social and economic implications of privacy in the context of safety, law, or ethics (e.g., 6.3.12.HistoryCA.1).
- 9.4.12.DC.4: Explain the privacy concerns related to the collection of data (e.g., cookies) and generation of data through automated processes that may not be evident to users (e.g., 8.1.12.NI.3).

- 9.4.12.DC.5: Debate laws and regulations that impact the development and use of software.
- 9.4.12.DC.6: Select information to post online that positively impacts personal image and future college and career opportunities.
- 9.4.12.DC.7: Evaluate the influence of digital communities on the nature, content and responsibilities of careers, and other aspects of society (e.g., 6.1.12.CivicsPD.16.a).
- 9.4.12.DC.8: Explain how increased network connectivity and computing capabilities of everyday objects allow for innovative technological approaches to climate protection.
- 9.4.12.GCA.1: Collaborate with individuals to analyze a variety of potential solutions to climate change effects and determine why some solutions (e.g., political, economic, cultural) may work better than others (e.g., SL.11-12.1., HS-ETS1-1, HS-ETS1-2, HS-ETS1-4, 6.3.12.GeoGI.1, 7.1.IH.IPERS.6, 7.1.IL.IPERS.7, 8.2.12.ETW.3).
- 9.4.12.IML.1: Compare search browsers and recognize features that allow for filtering of information.
- 9.4.12.IML.2: Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources (e.g., NJSLSA.W8, SocialStudies Practice: Gathering and Evaluating Sources).
- 9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.IH.IPRET.8).
- 9.4.12.IML.4: Assess and critique the appropriateness and impact of existing data visualizations for an intended audience (e.g., S-ID.B.6b, HS-LS2-4).
- 9.4.12.IML.5: Evaluate, synthesize, and apply information on climate change from various sources appropriately (e.g., 2.1.12.CHSS.6, S.IC.B.4, S.IC.B.6, 8.1.12.DA.1, 6.1.12.GeoHE.14.a, 7.1.AL.PRSNT.2).
- 9.4.12.IML.6: Use various types of media to produce and store information on climate change for different purposes and audiences with sensitivity to cultural, gender, and age diversity (e.g., NJSLSA.SL5).
- 9.4.12.IML.7: Develop an argument to support a claim regarding a current workplace or societal/ethical issue such as climate change (e.g., NJSLSA.W1, 7.1.AL.PRSNT.4).
- 9.4.12.IML.8: Evaluate media sources for point of view, bias, and motivations (e.g., NJSLSA.R6, 7.1.AL.IPRET.6).
- 9.4.12.IML.9: Analyze the decisions creators make to reveal explicit and implicit messages within information and media (e.g., 1.5.12acc.C2a, 7.1.IL.IPRET.4).

- 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task (e.g., W.11-12.6.).
- 9.4.12.TL.2: Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.
- 9.4.12.TL.3: Analyze the effectiveness of the process and quality of collaborative environments.
- 9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem (e.g., 7.1.AL.IPERS.6).

Interdisciplinary Connections:

Science and Engineering Practices:

- Develop a model based on evidence to illustrate the relationships between systems or between components of a system.
- Use a model to predict the relationships between systems or between components of a system.
- Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.
- Apply scientific ideas to solve a design problem, taking into account possible unanticipated effects.
- Create a computational model or simulation of a phenomenon, designed device, process, or system.
- Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.
- Evaluate the claims, evidence, and reasoning behind currently accepted explanations or solutions to determine the merits of arguments.
- Use mathematical and/or computational representations of phenomena or design solutions to support explanations.
- Make and defend a claim based on evidence about the natural world that reflects scientific knowledge, and student-generated evidence.
- Apply scientific reasoning to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion.

- Evaluate a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.

Engineering Design Standards:

- HS-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
- HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
- HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
- HS-ETS1-4 Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

Learning Targets

Unit Essential Questions:

- Why is it important to protect data stored in databases, and what are the consequences of failing to do so?
- How do attacks like SQL injection and XSS exploit vulnerabilities in code, and how can they be prevented?
- What role does risk management play in maintaining data security in real-world systems?

Unit Enduring Understandings:

- Securing stored data is critical to protecting privacy, preventing unauthorized access, and maintaining trust in digital systems.
- Understanding and defending against code-based vulnerabilities like SQLi and XSS is essential to building secure applications.
- Effective data security requires a comprehensive approach, including risk identification, assessment, prioritization, and mitigation.

• How can we design effective strategies (or tools, such as games) to teach others about cybersecurity threats and defenses? • In what ways can large sets of collected data be both beneficial and dangerous to individuals and organizations?	• Interactive tools like games can be powerful methods to communicate and reinforce cybersecurity concepts. • While large-scale data collection can offer valuable insights and services, it also introduces ethical and security risks that must be carefully managed.
Vocabulary: data, database, sql, sqli, xss, vulnerability, sanitization, risk, threat, mitigation, cybersecurity, encryption, prototype, testing, authentication, breach, exploit, firewall, secure coding	
Students will be able to: • Differentiate between data, information, and knowledge • Explain the different states of data (in use, in transit, at rest) and provide examples of each • Analyze the role of data centers in modern society • Identify and explain the major uses of a database management system • Define the different parts of a database (table, column, row) • Create new tables and entries using SQL code • Construct basic SQL queries using SELECT and WHERE keywords. • Identify major developer tools within the inspect element • Explain the purpose of developer tools • Utilize basic developer tools functions like “view-source” and the console. • Describe the potential vulnerabilities found within website code. • Explain the importance of specific security measures: mantrap, door lock, biometric locks, USB locks, privacy screen • Explain environmental impacts on devices and implement appropriate controls • Run and analyze simulated nmap scans • Identify key vulnerabilities in a fictional organization • Develop plans to attack vulnerabilities	

- Brainstorm and create a risk management game
- Create a prototype
- Test with a focus group

Learning Activities & Differentiation: *(Amistad & Holocaust, Asian American & Pacific Islanders, Climate Change, LGBTQ and People with Disabilities, Diversity, Equity & Inclusion [DEI])*

Learning Activities:

- Hardware Disassembly Lab: Students disassemble a computer using proper tools and procedures, identifying internal components and creating a labeled diagram of each.
- Peripheral Scavenger Hunt: Students locate, identify, and categorize different peripherals and port types around the classroom or in images/videos.
- Network Topology Design Challenge: Students design a distribution frame layout for a classroom or home network, including wired and wireless components, labeling connections and explaining choices.
- Cloud Storage Security Debate: Students research and debate the pros, cons, and security implications of local vs. cloud storage in different scenarios.
- Risk-Based Security Scenario: Students work in teams to evaluate IT system setups (mock scenarios) and recommend improvements using risk management principles.
- SQLi and XSS Simulations: Students conduct guided activities that simulate web-based attacks and defenses using CodeHS modules, followed by a group reflection on secure coding practices.
- Firewall & Protocol Lab: Students analyze firewall logs and match different ports and protocols to their functions in real-world systems.
- Troubleshooting Roleplay: Students simulate mock customer support calls where they practice communicating technical solutions clearly and professionally.

Differentiation Strategies:

- Advanced Learners: create virtual 3D models of systems, program a digital version of the Game of Risk, research and analyze famous cyberattacks

- Struggling Learners: use color-coded diagrams and simplified organizers, receive step-by-step lab guides, participate in teacher-led small group discussions
- English Language Learners (ELLs): use bilingual vocabulary flashcards, work with translated diagrams and instructions, watch subtitled videos and use sentence frames
- Universal Design for Learning (UDL): demonstrate understanding through diagrams or videos, use screen readers and closed captions, complete tactile network-building activities with physical components

Education Connections:

- Highlight contributions of diverse technologists such as Radia Perlman, Dr. Clarence Ellis, and Annie Easley.
- Explore ethical and privacy issues including surveillance, censorship, and digital inequality with historical and current event examples.
- Discuss global disparities in internet access and how they affect education, employment, and civic participation, especially in underserved communities.
- Examine how digital networks support inclusive practices like accessible web design, secure digital identities, and protocols for universal access.

Assessment Evidence

Formative Assessments:

- CodeHS exercises
    - Example Assignment: SQL Query Exploration

      In this activity, students will explore a database using the SQL query language.
    - Example Assignment: Can you gain access?

      The database in this item lists 100 of the most commonly used passwords. Attempt to gain access to a single record by guessing the password. Remember, this is a database of 100 of the most commonly used passwords. Can you guess at least 3 of them? How many can you guess?
- CodeHS Checks for Understanding

Summative Assessments:

- Project: The Game of Risk

Common Benchmark Assessments:

- Project: The Game of Risk

Alternative Assessments:

- CodeHS Unit Quiz

Core Instructional & Supplemental Materials

Core Materials:

- CodeHS Fundamentals of Cybersecurity – Module 8: Data Security & Module 9: Project: The Game of Risk
- CodeHS interactive lessons, quizzes, and coding activities covering databases, SQLi, XSS, secure coding, and risk management
- Guided simulations for SQL injection and XSS attacks to explore common vulnerabilities and their prevention
- Hands-on risk management scenarios including CyberGuard High School and secure data handling challenges
- Capture the Flag exercises to reinforce security concepts through interactive code exploration and page source inspection
- Game development project where students design a board or card game teaching randomized vulnerabilities and corresponding defenses
- Video content and readings introducing concepts such as data as a resource, cloud storage risks, secure coding practices, and cybersecurity defense planning
- Built-in CodeHS vocabulary tools and checkpoints focusing on data security, attack vectors, risk analysis, and secure programming controls

Supplemental Materials:

- Labeled diagrams and flowcharts illustrating types of attacks (SQLi, XSS), secure input handling, and risk mitigation strategies
- Graphic organizers and comparison charts for storage types, risk prioritization models, and defense techniques

- Templates for documenting risk assessments, security plans, and reflection logs from simulated attack activities
- Practice worksheets on analyzing vulnerable input fields, identifying attack vectors, and proposing secure code alternatives
- Case studies and discussion prompts exploring real-world data breaches, ethical use of stored data, and digital inequality in data protection
- Sentence frames, glossaries, and annotated code snippets to support English Language Learners and diverse learners
- Rubrics for evaluating game design, secure coding decisions, risk analysis depth, and communication of technical security concepts
- Printable quick-reference sheets for common attacks, database terminology, secure coding practices, and risk management frameworks

Accommodations and Modifications: Students with Disabilities, English Language Learners, Students at Risk of Failure, Students with 504s, Gifted & Talented Students

Specific Strategies and Practices that Support Students with Disabilities:

Students receiving Special Education programming have specific goals and objectives, as well as accommodations and modifications outlined within their Individualized Education Plans (IEP) due to an identified disability and/or diagnosis. In addition to exposure to the general education curriculum, the instruction is differentiated based upon the student's needs. The IEP acts as a supplemental curriculum guide inclusive of instructional strategies that support each learner.

- Small group/One to one – Review of directions – Student restates information – Extra visual and verbal cues and prompts – Verbal and visual cues regarding directions and staying on task – Checklists – Immediate feedback

Specific Strategies and Practices that Support English Language Learners

English language learner (ELL) is a national-origin-minority student who is limited-English-proficient. This term is often preferred over limited-English-proficient (LEP) as it highlights accomplishments rather than deficits.

- Pre-teaching of vocabulary and concepts – Personal Glossary – Simplified/Verbal Instructions – Visual learning, including graphic organizers – Teacher modeling – Scaffolding – Word walls – Think-pair-share – Cooperative learning groups

Students at Risk of Failure

- Home/School Connection – Alternative Assessments – Think-Pair-Share by Readiness – Differentiated Online Practice – Tiered Activities – Small Group Instruction – Group Work Choice

Students with 504 Plans

Teachers are responsible for implementing designated services and strategies identified on a student's 504 Plan.
504 plans are formal plans that schools develop to give kids the support they need and covers any condition that limits daily activities in a major way. Students' accommodations are outlined in their individual 504 plan.

Specific Strategies and Practices that Support Gifted & Talented Students

It is critical that all teachers are able to recognize a high-ability student who may need more depth and complexity in instruction.

-Homogenous Grouping - Small Group In-Depth Instruction

Unit 7

Desired Results

Unit 7 Title: Intro to AI & ML

Unit Summary:

In this unit, students will gain an understanding of the main concepts and vocabulary around AI. Students will also learn the fundamentals of machine learning, covering its lifecycle, supervised, unsupervised, and reinforcement learning, and explore bias within learning models.

Learning Standards

NJSLS:

- 8.1.12.CS.1: Describe ways in which integrated systems hide underlying implementation details to simplify user experiences.

- 8.1.12.CS.2: Model interactions between application software, system software, and hardware.
- 8.1.12.CS.3: Compare the functions of application software, system software, and hardware.
- 8.1.12.CS.4: Develop guidelines that convey systematic troubleshooting strategies that others can use to identify and fix errors.
- 8.1.12.NI.2: Evaluate security measures to address various common security threats.
- 8.1.12.NI.3: Explain how the needs of users and the sensitivity of data determine the level of security implemented.
- 8.1.12.IC.1: Evaluate the ways computing impacts personal, ethical, social, economic, and cultural practices.
- 8.1.12.IC.2: Test and refine computational artifacts to reduce bias and equity deficits.
- 8.1.12.IC.3: Predict the potential impacts and implications of emerging technologies on larger social, economic, and political structures, using evidence from credible sources.
- 8.1.12.DA.2: Describe the trade-offs in how and where data is organized and stored.
- 8.1.12.DA.3: Translate between decimal numbers and binary numbers.
- 8.1.12.DA.4: Explain the relationship between binary numbers and the storage and use of data in a computing device.
- 8.1.12.AP.1: Design algorithms to solve computational problems using a combination of original and existing algorithms.
- 8.1.12.AP.3: Select and combine control structures for a specific application based upon performance and readability, and identify trade-offs to justify the choice.
- 8.1.12.AP.4: Design and iteratively develop computational artifacts for practical intent, personal expression, or to address a societal issue.
- 8.1.12.AP.5: Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects.
- 8.1.12.AP.7: Collaboratively design and develop programs and artifacts for broad audiences by incorporating feedback from users.
- 8.1.12.AP.8: Evaluate and refine computational artifacts to make them more usable and accessible.
- 8.1.12.AP.9: Collaboratively document and present design decisions in the development of complex programs.
- 8.2.12.ED.1: Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers.

- 8.2.12.ED.4: Design a product or system that addresses a global problem and document decisions made based on research, constraints, trade-offs, and aesthetic and ethical considerations and share this information with an appropriate audience.
- 8.2.12.ETW.1: Evaluate ethical considerations regarding the sustainability of environmental resources that are used for the design, creation, and maintenance of a chosen product.
- 8.2.12.EC.1: Analyze controversial technological issues and determine the degree to which individuals, businesses, and governments have an ethical role in decisions that are made.
- 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.

Interdisciplinary Connections

Career Readiness, Life Literacies, & Key Skills *(CLKS)*:

- 9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
- 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).
- 9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition (e.g., 2.1.12.PGD.1).
- 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).
- 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).
- 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).
- 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.
- 9.4.12.DC.1: Explain the beneficial and harmful effects that intellectual property laws can have on the creation and sharing of content (e.g., 6.1.12.CivicsPR.16.a).
- 9.4.12.DC.2: Compare and contrast international differences in copyright laws and ethics.

- 9.4.12.DC.3: Evaluate the social and economic implications of privacy in the context of safety, law, or ethics (e.g., 6.3.12.HistoryCA.1).
- 9.4.12.DC.4: Explain the privacy concerns related to the collection of data (e.g., cookies) and generation of data through automated processes that may not be evident to users (e.g., 8.1.12.NI.3).
- 9.4.12.DC.5: Debate laws and regulations that impact the development and use of software.
- 9.4.12.DC.6: Select information to post online that positively impacts personal image and future college and career opportunities.
- 9.4.12.DC.7: Evaluate the influence of digital communities on the nature, content and responsibilities of careers, and other aspects of society (e.g., 6.1.12.CivicsPD.16.a).
- 9.4.12.DC.8: Explain how increased network connectivity and computing capabilities of everyday objects allow for innovative technological approaches to climate protection.
- 9.4.12.GCA.1: Collaborate with individuals to analyze a variety of potential solutions to climate change effects and determine why some solutions (e.g., political. economic, cultural) may work better than others (e.g., SL.11-12.1., HS-ETS1-1, HS-ETS1-2, HS-ETS1-4, 6.3.12.GeoGI.1, 7.1.IH.IPERS.6, 7.1.IL.IPERS.7, 8.2.12.ETW.3).
- 9.4.12.IML.1: Compare search browsers and recognize features that allow for filtering of information.
- 9.4.12.IML.2: Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources (e.g., NJSLSA.W8, SocialStudies Practice: Gathering and Evaluating Sources).
- 9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.IH.IPRET.8).
- 9.4.12.IML.4: Assess and critique the appropriateness and impact of existing data visualizations for an intended audience (e.g., S-ID.B.6b, HS-LS2-4).
- 9.4.12.IML.5: Evaluate, synthesize, and apply information on climate change from various sources appropriately (e.g., 2.1.12.CHSS.6, S.IC.B.4, S.IC.B.6, 8.1.12.DA.1, 6.1.12.GeoHE.14.a, 7.1.AL.PRSNT.2).
- 9.4.12.IML.6: Use various types of media to produce and store information on climate change for different purposes and audiences with sensitivity to cultural, gender, and age diversity (e.g., NJSLSA.SL5).
- 9.4.12.IML.7: Develop an argument to support a claim regarding a current workplace or societal/ethical issue such as climate change (e.g., NJSLSA.W1, 7.1.AL.PRSNT.4).

- 9.4.12.IML.8: Evaluate media sources for point of view, bias, and motivations (e.g., NJSLSA.R6, 7.1.AL.IPRET.6).
- 9.4.12.IML.9: Analyze the decisions creators make to reveal explicit and implicit messages within information and media (e.g., 1.5.12acc.C2a, 7.1.IL.IPRET.4).
- 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task (e.g., W.11-12.6.).
- 9.4.12.TL.2: Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.
- 9.4.12.TL.3: Analyze the effectiveness of the process and quality of collaborative environments.
- 9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem (e.g., 7.1.AL.IPERS.6).

Interdisciplinary Connections:

Science and Engineering Practices:

- Develop a model based on evidence to illustrate the relationships between systems or between components of a system.
- Use a model to predict the relationships between systems or between components of a system.
- Apply scientific principles and evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.
- Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.
- Use mathematical and/or computational representations of phenomena or design solutions to support explanations.
- Create a computational model or simulation of a phenomenon, designed device, process, or system.
- Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.
- Apply scientific reasoning to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion.

- Communicate scientific and technical information (e.g. about the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically).

Engineering Design Standards:

- HS-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
- HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
- HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
- HS-ETS1-4 Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

Learning Targets

Unit Essential Questions:

- What is artificial intelligence, and how is it already influencing our everyday lives?
- How do generative and predictive AI models differ in function and use?
- What role do large language models play in the development of conversational AI, and how do we interact with them effectively?

Unit Enduring Understandings:

- Artificial Intelligence is a branch of computer science that enables machines to perform tasks that typically require human intelligence.
- Generative AI creates new content (e.g., text, images) based on patterns it has learned, while predictive AI forecasts outcomes based on past data.
- Large language models, like ChatGPT, use vast datasets to simulate human-like conversations, and effective prompts are key to quality outputs.

• How do machines learn from data, and what are the differences between supervised, unsupervised, and reinforcement learning? • How can bias enter machine learning models, and what are the potential consequences of biased AI systems?	• Machine learning enables computers to improve performance over time through experience, and it involves different models depending on how data is labeled and used. • Bias in training data or model design can lead to unfair or inaccurate AI outputs, making ethical considerations critical in AI development.
Vocabulary: artificial intelligence, generative ai, predictive ai, large language model, prompt engineering, machine learning, supervised learning, unsupervised learning, reinforcement learning, bias, model, algorithm, dataset, input, output, training data, neural network, chatbot, feedback, reward	
Students will be able to: • Define intelligence as it will be used in this course • Describe the Turing Test, its uses, and where it falls short • Engage with various resources to gauge the intelligence level of AI tools • Describe the difference between generative and predictive AI tools • Explain the boundaries of generative and predictive AI tools • Describe what Large Language Models and Multimidal Models are at a high level • Students will be able to prompt quality outputs from LLMs • Students will be able to use LLMs to produce code • Describe what prompt engineering is and common techniques • Apply common prompt engineering techniques to produce better outputs • Explain the diversity issues that surround the AI industry • Explain how the data used to train models is labeled • Engage in meaningful discourse about the state of AI and who is allowed to work on the technology • Define machine learning, neural networks, and convolutional neural networks • Understand the process of a convolutional neural network and its inner workings	

- explain how supervised learning is used to train an AI model
- explain the benefits of using a supervised learning method
- explain how unsupervised learning is used to train an AI model
- explain the benefits of using an unsupervised learning method
- explain how reinforcement learning is used to train an AI model
- explain the benefits of using a reinforcement learning method

Learning Activities & Differentiation: *(Amistad & Holocaust, Asian American & Pacific Islanders, Climate Change, LGBTQ and People with Disabilities, Diversity, Equity & Inclusion [DEI])*

Learning Activities:

- Generative vs. Predictive AI Scavenger Hunt: Students identify and categorize examples of generative and predictive AI tools from online resources, explaining their differences and use cases.
- Prompt Engineering Design Challenge: Students craft prompts to generate images, text, or code using AI tools like ChatGPT or Gemini, then analyze how prompt variations impact outputs.
- Machine Learning Model Building: Using Teachable Machine, students create supervised learning models (e.g., apples vs bananas), label data, and test model accuracy.
- Unsupervised Learning Sound Classification: Students explore unlabeled data by categorizing bird sounds using AI tools, reflecting on how the model groups data without labels.
- Reinforcement Learning Simulation: Students engage with a visual reinforcement learning game, adjusting strategies to maximize rewards, and discuss learning through feedback.
- Bias in AI Case Study Discussion: Students analyze examples of bias in AI systems, review how training data affects outcomes, and participate in a structured debate on ethical AI development.
- LLM Comparison Activity: Students compare outputs from different Large Language Models via Chatbot Arena and evaluate their effectiveness in various scenarios.

Differentiation Strategies:

- Advanced Learners: Develop mini projects applying prompt engineering to create custom AI outputs; research

historical and current AI ethical dilemmas; analyze LLM architectures at a technical level.
- Struggling Learners: Use graphic organizers and step-by-step instructions; access pre-labeled datasets; participate in small group discussions led by the teacher; use simplified vocabulary and scaffolded reflections.
- English Language Learners (ELLs): Utilize bilingual glossaries of AI terms; work with visual diagrams and translated instructions; watch subtitled tutorials; use sentence frames for discussions.
- Universal Design for Learning (UDL): Demonstrate understanding through multimedia presentations (videos, infographics, or drawings); use speech-to-text tools; engage in tactile activities like sorting labeled data cards to simulate learning types.

Education Connections:

- Highlight contributions of diverse AI pioneers such as Fei-Fei Li (Asian American AI researcher), Joy Buolamwini (AI ethics advocate), and Timnit Gebru (AI fairness expert).
- Explore ethical issues including AI bias, surveillance, and data privacy, with historical and current examples demonstrating the social impact of AI.
- Discuss global disparities in AI research and access, and how these gaps influence education, job opportunities, and participation in technology development, particularly in marginalized communities.
- Examine how AI can support inclusive practices, such as accessible voice interfaces for people with disabilities and language translation tools that bridge communication barriers.

Assessment Evidence

Formative Assessments:

- CodeHS exercises
    - Example Assignment: Generative vs Predictive - Explore Google Experiments
      Students explore different applications of AI through Google Experiments
    - Example Assignment: Supervised Learning - Apples vs Bananas
      Students use Teachable Machine to build a model that categorizes apples and bananas

- CodeHS Checks for Understanding

Summative Assessments:

- Prompt Engineering: Generate an Image
- Reinforcement Learning: Reinforcement Learning Game

Common Benchmark Assessments:

- Prompt Engineering: Generate an Image
- Reinforcement Learning: Reinforcement Learning Game

Alternative Assessments:

- CodeHS Unit Quiz

Core Instructional & Supplemental Materials

Core Materials:

- CodeHS Intro to AI & Machine Learning Modules: Interactive lessons, quizzes, and coding activities covering AI fundamentals, machine learning types (supervised, unsupervised, reinforcement), and ethical considerations.
- Hands-on AI Tools: Guided activities using platforms like Google Teachable Machine, Chatbot Arena, Hugging Face, and TensorFlow to build and test models.
- Prompt Engineering Labs: Exercises using ChatGPT, Gemini, and other LLMs for generating text, code, and images, focusing on crafting effective prompts.
- Bias & Ethics Case Studies: Interactive readings and videos exploring bias in AI, diversity issues in AI development, and societal impacts.
- Simulated Machine Learning Workflows: Visualizations of convolutional neural networks and reinforcement learning simulations.
- Discussion and Reflection Prompts: Guided group activities to foster discourse on who develops AI, access disparities, and AI's role in society.

- Built-in Vocabulary Tools and Checkpoints: Focus on AI terminology, machine learning concepts, prompt engineering, and ethical AI principles.

Supplemental Materials:

- Labeled Diagrams and Flowcharts: Illustrations of machine learning workflows, neural network layers, types of learning, and data labeling processes.
- Graphic Organizers and Comparison Charts: Visual aids contrasting generative vs. predictive AI, supervised vs. unsupervised vs. reinforcement learning, and common AI biases.
- Templates for Model Documentation: Worksheets for students to document their AI models' design, data labeling decisions, and evaluation of bias or accuracy.
- Practice Prompts and Response Logs: Exercises for experimenting with prompt engineering techniques and recording output variations.
- Case Studies and Discussion Guides: Materials on real-world AI applications, ethical dilemmas, and diversity in AI teams to prompt critical thinking.
- Sentence Frames, Glossaries, and Annotated Examples: Support materials tailored for English Language Learners and diverse learners to engage with technical content.
- Rubrics for Assessments: Criteria for evaluating AI model design, prompt engineering effectiveness, ethical reasoning, and technical communication.
- Quick-Reference Sheets: Summaries of AI and machine learning concepts, key terminology, prompt engineering tips, and ethical guidelines.

Accommodations and Modifications: Students with Disabilities, English Language Learners, Students at Risk of Failure, Students with 504s, Gifted & Talented Students

Specific Strategies and Practices that Support Students with Disabilities:

Students receiving Special Education programming have specific goals and objectives, as well as accommodations and modifications outlined within their Individualized Education Plans (IEP) due to an identified disability and/or diagnosis. In addition to exposure to the general education curriculum, the instruction is differentiated based upon the student's needs. The IEP acts as a supplemental curriculum guide inclusive of instructional strategies that support each learner.

- Small group/One to one - Additional time - Review of directions - Extra visual and verbal cues and prompts - Preferential seating - Rest breaks - Checklists

Specific Strategies and Practices that Support English Language Learners

English language learner (ELL) is a national-origin-minority student who is limited-English-proficient. This term is often preferred over limited-English-proficient (LEP) as it highlights accomplishments rather than deficits.

- Pre-teaching of vocabulary and concepts - Extended Time - Simplified/Verbal Instructions - Frequent Breaks - Visual learning, including graphic organizers - Teacher modeling - Scaffolding - Think-pair-share

Students at Risk of Failure

- Home/School Connection - Alternative Assessments - Learning Contracts - Supplemental Instruction - Homework Options - Differentiated Online Practice - Leveled Rubrics - Small Group Instruction - Group Work Choice

Students with 504 Plans

Teachers are responsible for implementing designated services and strategies identified on a student's 504 Plan.
504 plans are formal plans that schools develop to give kids the support they need and covers any condition that limits daily activities in a major way. Students' accommodations are outlined in their individual 504 plan.

Specific Strategies and Practices that Support Gifted & Talented Students

It is critical that all teachers are able to recognize a high-ability student who may need more depth and complexity in instruction.

- Small Group In-Depth Instruction - Differentiated Online Practice

Unit 8

Desired Results

Unit 8 Title: Training AI & AI Risks

Unit Summary:

In this hands-on unit, students will learn how to train AI models using Teachable Machine and will explore the use cases for AI in various industries. Students will also explore the ethical implications and risks of AI technology, including bias, hallucinations, security, misinformation, and legal challenges, ending in a debate about AI.

Learning Standards

NJSLS:

- 8.1.12.CS.1: Describe ways in which integrated systems hide underlying implementation details to simplify user experiences.
- 8.1.12.CS.2: Model interactions between application software, system software, and hardware.
- 8.1.12.CS.3: Compare the functions of application software, system software, and hardware.
- 8.1.12.CS.4: Develop guidelines that convey systematic troubleshooting strategies that others can use to identify and fix errors.
- 8.1.12.NI.2: Evaluate security measures to address various common security threats.
- 8.1.12.IC.1: Evaluate the ways computing impacts personal, ethical, social, economic, and cultural practices.
- 8.1.12.IC.2: Test and refine computational artifacts to reduce bias and equity deficits.
- 8.1.12.IC.3: Predict the potential impacts and implications of emerging technologies on larger social, economic, and political structures, using evidence from credible sources.
- 8.1.12.AP.4: Design and iteratively develop computational artifacts for practical intent, personal expression, or to address a societal issue.
- 8.1.12.AP.5: Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects.
- 8.1.12.AP.7: Collaboratively design and develop programs and artifacts for broad audiences by incorporating feedback from users.
- 8.1.12.AP.8: Evaluate and refine computational artifacts to make them more usable and accessible.
- 8.1.12.AP.9: Collaboratively document and present design decisions in the development of complex programs.
- 8.2.12.ITH.1: Analyze a product to determine the impact that economic, political, social, and/or cultural factors have had on its design, including its design constraints.
- 8.2.12.ITH.2: Propose an innovation to meet future demands supported by an analysis of the potential costs,

benefits, trade-offs, and risks related to the use of the innovation.

- 8.2.12.EC.1: Analyze controversial technological issues and determine the degree to which individuals, businesses, and governments have an ethical role in decisions that are made.
- 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.

Interdisciplinary Connections

Career Readiness, Life Literacies, & Key Skills *(CLKS)*:

- 9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
- 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).
- 9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition (e.g., 2.1.12.PGD.1).
- 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).
- 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).
- 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).
- 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.
- 9.4.12.DC.1: Explain the beneficial and harmful effects that intellectual property laws can have on the creation and sharing of content (e.g., 6.1.12.CivicsPR.16.a).
- 9.4.12.DC.2: Compare and contrast international differences in copyright laws and ethics.
- 9.4.12.DC.3: Evaluate the social and economic implications of privacy in the context of safety, law, or ethics (e.g., 6.3.12.HistoryCA.1).

- 9.4.12.DC.4: Explain the privacy concerns related to the collection of data (e.g., cookies) and generation of data through automated processes that may not be evident to users (e.g., 8.1.12.NI.3).
- 9.4.12.DC.5: Debate laws and regulations that impact the development and use of software.
- 9.4.12.DC.6: Select information to post online that positively impacts personal image and future college and career opportunities.
- 9.4.12.DC.7: Evaluate the influence of digital communities on the nature, content and responsibilities of careers, and other aspects of society (e.g., 6.1.12.CivicsPD.16.a).
- 9.4.12.DC.8: Explain how increased network connectivity and computing capabilities of everyday objects allow for innovative technological approaches to climate protection.
- 9.4.12.GCA.1: Collaborate with individuals to analyze a variety of potential solutions to climate change effects and determine why some solutions (e.g., political. economic, cultural) may work better than others (e.g., SL.11-12.1., HS-ETS1-1, HS-ETS1-2, HS-ETS1-4, 6.3.12.GeoGI.1, 7.1.IH.IPERS.6, 7.1.IL.IPERS.7, 8.2.12.ETW.3).
- 9.4.12.IML.1: Compare search browsers and recognize features that allow for filtering of information.
- 9.4.12.IML.2: Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources (e.g., NJSLSA.W8, SocialStudies Practice: Gathering and Evaluating Sources).
- 9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.IH.IPRET.8).
- 9.4.12.IML.4: Assess and critique the appropriateness and impact of existing data visualizations for an intended audience (e.g., S-ID.B.6b, HS-LS2-4).
- 9.4.12.IML.5: Evaluate, synthesize, and apply information on climate change from various sources appropriately (e.g., 2.1.12.CHSS.6, S.IC.B.4, S.IC.B.6, 8.1.12.DA.1, 6.1.12.GeoHE.14.a, 7.1.AL.PRSNT.2).
- 9.4.12.IML.6: Use various types of media to produce and store information on climate change for different purposes and audiences with sensitivity to cultural, gender, and age diversity (e.g., NJSLSA.SL5).
- 9.4.12.IML.7: Develop an argument to support a claim regarding a current workplace or societal/ethical issue such as climate change (e.g., NJSLSA.W1, 7.1.AL.PRSNT.4).
- 9.4.12.IML.8: Evaluate media sources for point of view, bias, and motivations (e.g., NJSLSA.R6, 7.1.AL.IPRET.6).

- 9.4.12.IML.9: Analyze the decisions creators make to reveal explicit and implicit messages within information and media (e.g., 1.5.12acc.C2a, 7.1.IL.IPRET.4).
- 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task (e.g., W.11-12.6.).
- 9.4.12.TL.2: Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.
- 9.4.12.TL.3: Analyze the effectiveness of the process and quality of collaborative environments.
- 9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem (e.g., 7.1.AL.IPERS.6).

Interdisciplinary Connections:

Science and Engineering Practices:

- Develop a model based on evidence to illustrate the relationships between systems or between components of a system.
- Use a model to predict the relationships between systems or between components of a system.
- Apply scientific principles and evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.
- Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.
- Create a computational model or simulation of a phenomenon, designed device, process, or system.
- Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.
- Evaluate the claims, evidence, and reasoning behind currently accepted explanations or solutions to determine the merits of arguments.
- Evaluate the validity and reliability of multiple claims that appear in scientific and technical texts or media reports, verifying the data when possible.
- Use mathematical and/or computational representations of phenomena or design solutions to support explanations.

- Make and defend a claim based on evidence about the natural world that reflects scientific knowledge, and student-generated evidence.
- Create or revise a simulation of a phenomenon, designed device, process, or system.
- Apply scientific reasoning to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion.
- Construct an oral and written argument or counter-arguments based on data and evidence.
- Evaluate a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.

Engineering Design Standards:

- HS-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
- HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
- HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
- HS-ETS1-4 Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

Learning Targets

Unit Essential Questions:	**Unit Enduring Understandings:**
• How are artificial intelligence (AI) models trained, and what role does data play in this process?	• AI models learn from training data, and the quality and diversity of this data critically influence their performance and fairness.

• In what ways is AI currently being used across different industries, and how might this evolve in the future? • What are the ethical risks of using AI, particularly when training data is biased or incomplete? • How can AI technologies be manipulated to create misinformation, such as deepfakes or hallucinated content? • What legal and societal challenges arise from the increasing use of generative AI in decision-making and media?	• AI is transforming multiple industries by automating tasks, improving decision-making, and enabling new forms of interaction. • Bias in AI systems often stems from biased data and can lead to real-world harm if not addressed during model development. • Generative AI tools can create convincing but false information, which raises significant security and misinformation concerns. • The use of AI raises complex ethical and legal issues that require thoughtful debate, regulation, and informed public discourse.
Vocabulary: ai, model, training data, bias, hallucination, deepfake, misinformation, security, ethics, prompt injection, industry, automation, generative ai, legal challenges, debate	
Students will be able to: • Explain how AI models are created from training data • Use Teachable Machine to train a model that will be used in an HTML program • Explore the use cases of AI in industries such as healthcare, fashion, animal sciences, sales, and music • Use Teachable Machine to engage with data in various ways • Explain the concept of biased training data • Describe how the use of biased training data can affect an AI model • Articulate their position on ethical issues in AI. • Explain how humans can be biased and the impact that they have. • Explain what hallucinations are and their dangers • Describe what prompt injections are and how they can cause harm • Demonstrate how AI safeguards can be bypassed	

- Define and better identify deepfakes
- Explain the challenges that deepfakes present
- Discuss the legal challenges that surround AI
- Demonstrate the ability to take a stance on AI and make arguments

Learning Activities & Differentiation: *(Amistad & Holocaust, Asian American & Pacific Islanders, Climate Change, LGBTQ and People with Disabilities, Diversity, Equity & Inclusion [DEI])*

Learning Activities:

- Generative vs. Predictive AI Scavenger Hunt: Students identify and categorize examples of generative and predictive AI tools from online resources, explaining their differences and use cases.
- Prompt Engineering Design Challenge: Students craft prompts to generate images, text, or code using AI tools like ChatGPT or Gemini, then analyze how prompt variations impact outputs.
- Machine Learning Model Building: Using Teachable Machine, students create supervised learning models (e.g., apples vs bananas), label data, and test model accuracy.
- Unsupervised Learning Sound Classification: Students explore unlabeled data by categorizing bird sounds using AI tools, reflecting on how the model groups data without labels.
- Reinforcement Learning Simulation: Students engage with a visual reinforcement learning game, adjusting strategies to maximize rewards, and discuss learning through feedback.
- Bias in AI Case Study Discussion: Students analyze examples of bias in AI systems, review how training data affects outcomes, and participate in a structured debate on ethical AI development.
- LLM Comparison Activity: Students compare outputs from different Large Language Models via Chatbot Arena and evaluate their effectiveness in various scenarios.

Differentiation Strategies:

- Advanced Learners: Develop mini-projects applying prompt engineering to create custom AI outputs; research historical and current AI ethical dilemmas; analyze LLM architectures at a technical level.
- Struggling Learners: Use graphic organizers and step-by-step instructions; access pre-labeled datasets; participate

in small group discussions led by the teacher; use simplified vocabulary and scaffolded reflections.
- English Language Learners (ELLs): Utilize bilingual glossaries of AI terms; work with visual diagrams and translated instructions; watch subtitled tutorials; use sentence frames for discussions.
- Universal Design for Learning (UDL): Demonstrate understanding through multimedia presentations (videos, infographics, or drawings); use speech-to-text tools; engage in tactile activities like sorting labeled data cards to simulate learning types.

Education Connections:

- Highlight contributions of diverse AI pioneers such as Fei-Fei Li (Asian American AI researcher), Joy Buolamwini (AI ethics advocate), and Timnit Gebru (AI fairness expert).
- Explore ethical issues including AI bias, surveillance, and data privacy, with historical and current examples demonstrating the social impact of AI.
- Discuss global disparities in AI research and access, and how these gaps influence education, job opportunities, and participation in technology development, particularly in marginalized communities.
- Examine how AI can support inclusive practices, such as accessible voice interfaces for people with disabilities and language translation tools that bridge communication barriers.

Assessment Evidence

Formative Assessments:

- CodeHS exercises
    - Example Assignment: How Are AI Models Trained - Turning on a Light
      Students train and use an AI model to control a program
    - Example Assignment: Deepfakes and Misinformation
      Students learn how deepfakes are created and how they can spot and defend themselves from the dangers they pose
- CodeHS Checks for Understanding

Summative Assessments:

- Project: AI on Trial

Common Benchmark Assessments:

- Project: AI on Trial

Alternative Assessments:

- CodeHS Unit Quiz

Core Instructional & Supplemental Materials

Core Materials:

- CodeHS Intro to AI & Machine Learning Modules: Interactive lessons, quizzes, and coding activities covering AI fundamentals, types of machine learning (supervised, unsupervised, reinforcement), and ethical considerations.
- Hands-on AI Tools: Guided activities using platforms like Google Teachable Machine, Chatbot Arena, Hugging Face, and TensorFlow to build, train, and test AI models.
- Prompt Engineering Labs: Exercises using ChatGPT, Gemini, and other large language models (LLMs) to generate text, code, and images, with an emphasis on crafting and refining effective prompts.
- Bias & Ethics Case Studies: Interactive readings, documentaries, and analysis tasks exploring bias in AI, diversity in AI development, and the societal consequences of algorithmic decision-making.
- Simulated Machine Learning Workflows: Visual demonstrations of concepts such as convolutional neural networks (CNNs), image classification, and reinforcement learning strategies.

Supplemental Materials:

- Labeled Diagrams and Flowcharts: Visuals of machine learning workflows, neural network structures, types of learning, and data labeling techniques.
- Graphic Organizers and Comparison Charts: Tools comparing generative vs. predictive AI, supervised vs. unsupervised vs. reinforcement learning, and examples of bias in AI systems.
- Templates for Model Documentation: Worksheets for recording the design of AI models, choices in training data, testing results, and analysis of accuracy and fairness.

- Practice Prompts and Response Logs: Guided exercises to experiment with different prompt styles and log how AI-generated responses change based on input.
- Case Studies and Discussion Guides: Resources focused on real-world applications of AI (e.g., healthcare, law enforcement, education), exploring both benefits and challenges, especially related to ethics and diversity.
- Sentence Frames, Glossaries, and Annotated Examples: Language support tools designed for English Language Learners and diverse learners to scaffold technical vocabulary and concepts.
- Rubrics for Assessments: Evaluation tools for student performance on AI model design, prompt effectiveness, ethical analysis, and written reflections.
- Quick-Reference Sheets: One-pagers summarizing machine learning types, AI key terms, prompt writing tips, and ethical considerations for fast review or support.

Accommodations and Modifications: Students with Disabilities, English Language Learners, Students at Risk of Failure, Students with 504s, Gifted & Talented Students

Specific Strategies and Practices that Support Students with Disabilities:

Students receiving Special Education programming have specific goals and objectives, as well as accommodations and modifications outlined within their Individualized Education Plans (IEP) due to an identified disability and/or diagnosis. In addition to exposure to the general education curriculum, the instruction is differentiated based upon the student's needs. The IEP acts as a supplemental curriculum guide inclusive of instructional strategies that support each learner.

– Review of directions – Extra visual and verbal cues and prompts – Verbal and visual cues regarding directions and staying on task – Checklists – Immediate feedback

Specific Strategies and Practices that Support English Language Learners

English language learner (ELL) is a national-origin-minority student who is limited-English-proficient. This term is often preferred over limited-English-proficient (LEP) as it highlights accomplishments rather than deficits.

- Personal Glossary – Simplified/Verbal Instructions – Visual learning, including graphic organizers – Teacher modeling – Scaffolding – Think-pair-share – Cooperative learning groups

Students at Risk of Failure

- Think-Pair-Share by Readiness – Differentiated Online Practice – Leveled Rubrics – Tiered Activities – Small Group Instruction – Group Work Choice

Students with 504 Plans

Teachers are responsible for implementing designated services and strategies identified on a student's 504 Plan.
504 plans are formal plans that schools develop to give kids the support they need and covers any condition that limits daily activities in a major way. Students' accommodations are outlined in their individual 504 plan.

Specific Strategies and Practices that Support Gifted & Talented Students

It is critical that all teachers are able to recognize a high-ability student who may need more depth and complexity in instruction.

- Differentiated Online Practice – Alternative Assessments – Pre-Assess to provide Differentiated Instruction to Accelerate Learning