NORTH DAKOTA DEPARTMENT OF
PUBLIC INSTRUCTION

North Dakota
Computer Science and Cybersecurity
Content Standards
Grades K–12
Draft 2 2024

North Dakota Department of Public Instruction
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Document Revision Log

Date Revised	Description of Revision	Page

Contents

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Superintendent's Foreword

Introduction

Scope of the Standards

The purpose of these standards is to define what North Dakota learners should know about computer science and cybersecurity. Individuals interested in a career in computer science and cybersecurity can expand their studies through North Dakota Career and Technical Education and other disciplinary opportunities.

Throughout the creation of the standards, the committee was cognizant of the range of technologies and access available in school districts throughout our state. The standards focus on necessary skills and do not require districts to utilize specific hardware or software.

Artificial Intelligence within the Standards

Emerging technologies change rapidly in our current society. To ensure longevity, the committee intentionally did not name a specific type or category of Artificial Intelligence (AI). Efforts were made to develop general standards for the obsolescence and emergence of technologies.

When these standards were written, large language models emerged as the general public's understanding of Artificial Intelligence (AI). AI is a more encompassing concept than large language models, and the future of AI is unknown. The standards include AI in the following ways:

- **Computing Devices and Systems:** AI technology is embedded in computing devices, creating systems to help with processing data, making decisions, and performing tasks from learned patterns.
- **Algorithms and Computational Thinking:** AI uses algorithms to process collected data, identify patterns, and solve problems. Algorithmic thinking is essential for AI, as it involves creating step-by-step solutions that AI can follow.
- **Impacts of Computing:** As with all emerging technologies, AI will impact our society and will influence future policies, laws, and ethics. The existence of AI requires societal reflection.
- **Digital Citizenship:** As AI becomes integrated into more aspects of daily life, digital citizens need an understanding of AI concepts to navigate AI-powered environments responsibly.
- **Security:** AI has a profound positive impact on security by predicting and enhancing threat detection but also increases potential risks, including adversarial attacks and privacy concerns.

Composition of the Standards – Standards vs. Curriculum

These standards are the goals that learners should achieve by the time they graduate from a North Dakota high school. This differs from the curriculum used by educators which includes the resources and instructional strategies to assist learners in meeting the standards. Curriculum development has been and continues to be the responsibility of the individual school districts.

Standards Development Process

The development of the North Dakota Computer Science and Cybersecurity Content Standards was a multi-phase process. State Superintendent of Public Instruction Kirsten Baesler established a statewide committee through an application process that included teachers, administrators, and higher education faculty. Over four multi-day sessions, the committee developed a new set of standards. The committee began by reviewing state and national standards. The work was guided by current disciplinary knowledge and research in computer science and cybersecurity education,

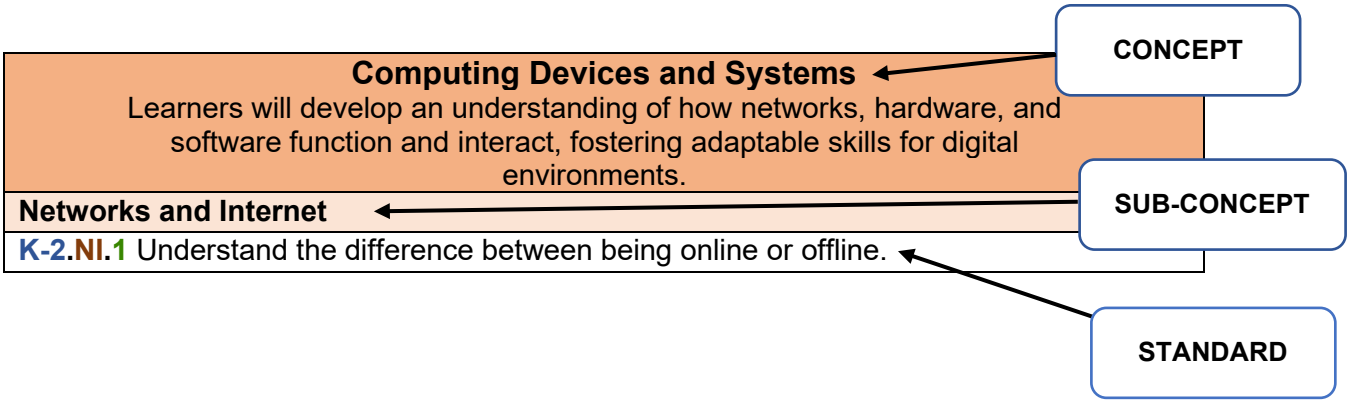
including existing state and national frameworks and presentations by industry experts. Drawing from the information gained from those sources, the committee drafted the initial North Dakota Computer Science and Cybersecurity Content Standards. Input from the public and the content standards review committee was used to inform the development of the new standards. The committee began its work in July 2024 and completed the development of the new standards in February 2025.

Organization of the Standards

The standards are organized into concepts and then branch out into sub-concepts with the individual standards developed using grade-level bands. The committee voted to use grade-level bands to allow school districts more agency when the standards are incorporated into the curriculum and to allow teachers to scaffold the skills for continued growth and increased rigor within each grade-level band. It is the understanding that learners will be proficient in the standard at the end of the grade-level band. A limited number of standards such as the responsible and acceptable use policies repeat throughout multiple grade-level bands. The committee believed the rigor would increase naturally as learners' interests, abilities, and access to resources grow.

How to Read the Standards

The standards are organized into five main concepts: Computing Devices and Systems, Algorithms and Computational Thinking, Impacts of Computing, Digital Citizenship, and Security, broken into smaller sub-concepts under each main concept and finally into individual standards under each sub-concept. The standards are organized by grade level to allow more focus on skills at particular levels.



CODING EXAMPLE

K-2 – Grade Span

NI – Sub-Concept

1 – Standard Number

Resources

Cyber Innovation Center & CYBER.ORG. (2021). *K-12 Cybersecurity Learning Standards*. Retrieved from https://cyber.org/standards

North Dakota Department of Public Instruction. (2019). *North Dakota Computer Science and Cybersecurity Standards*. Retrieved from https://www.nd.gov/dpi/sites/www/files/documents/Academic%20Support/CSCS2019.pdf

North Dakota Department of Public Instruction. (2022). *North Dakota Library Media Content Standards*. Retrieved from https://www.nd.gov/dpi/sites/www/files/documents/Academic%20Support/FINAL%20Library%20Media%20Standards.pdf

Oklahoma State Department of Education. (2023). *Oklahoma Academic Standards for Computer Science*. Retrieved from https://sde.ok.gov/documents/2018-02-22/proposed-oas-cs

OpenAI. (2024). *ChatGPT* (GPT-40 version) [Large language model]. Retrieved from https://chat.openai.com/chat

Virginia Department of Education. (2024). *2024 Computer Science Standards of Learning*. Retrieved from https://www.doe.virginia.gov/teaching-learning-assessment/k-12-standards-instruction/computer-science/2024-computer-science-standards-of-learning

Kindergarten – Second Grade

Computing Devices and Systems *Learners will develop an understanding of how networks, hardware, and software function and interact, fostering adaptable skills for digital environments.*
Networks and Internet
K-2.NI.1 Compare the difference between being online and offline.
K-2.NI.2 Identify devices that can be connected to the internet.
K-2.NI.3 Identify that information can be stored and shared online.
Hardware and Software
K-2.HS.1 Use software to accomplish a task.
K-2.HS.2 Identify the components (e.g., screen, keyboard, mouse, power button) and basic functions of a computing device.
K-2.HS.3 Recognize that digital information can be organized, stored, and retrieved.
Algorithms and Computational Thinking *Learners will develop and apply a basic understanding of algorithms and computational thinking, enhancing problem-solving and critical-thinking skills.*
Developing and Designing Algorithms
K-2.DD.1 Break a task into smaller steps to identify patterns or solve problems.
K-2.DD.2 Create an algorithm that uses a sequence to solve a problem.
K-2.DD.3 Identify examples of patterns and conditionals in daily life.
Analyzing and Problem Solving
K-2.AP.1 Organize collected data to make a prediction with or without a computing device.
K-2.AP.2 Identify and correct errors in algorithms or processes.
K-2.AP.3 *Standard begins in grade 6.*
Impacts of Computing *Learners will understand how technology shapes individuals and the world and influences safety policy, law, and ethics.*
Policies and Laws
K-2.PL.1 Demonstrate an understanding that creative works are protected by law. (Library Media 2.IP.1)
K-2.PL.2 Understand the purpose of and comply with responsible and acceptable use policies. (Library Media 2.RU.1)
K-2.PL.3 *Standard begins in grade 6.*
Ethics
K-2.E.1 Describe the positive and negative uses of technology.
K-2.E.2 Identify facts and opinions. (Library Media 2.E.1)
Societal Impacts
K-2.S.1 Identify the positive and negative impacts of technology on how people live, work, and interact.
K-2.S.2 Identify how current and emerging technologies impact individuals.

Kindergarten – Second Grade

Digital Citizenship *Learners will practice responsible digital consumption, creation, communication, and interaction.*
Digital Well-Being
K-2.DW.1 Identify appropriate times to use technology and times to be screen-free. (Library Media 2.RU.5)
K-2.DW.2 Discuss the potential impact of technology use on one's learning and relationships.
Digital Identity
K-2.DI.1 With guidance, understand that using technology creates a digital footprint.
Social Interactions
K-2.SI.1 Identify social interactions that can impact self and others. (Library Media 2.SI.2)
K-2.SI.2 Discuss appropriate online behavior, the effects on individuals, and age-appropriate responses.
Security *To protect individuals and organizations, learners will gain a foundational understanding of safe and best practices for data and system security, including information, network, and physical security.*
Personally Identifiable Information
K-2.PI.1 Identify public versus private information, listing examples of information that needs to be protected.
Threats and Vulnerability
K-2.TV.1 Understand that cybersecurity threats exist (e.g., phishing, malware, clickbait). (Library Media 2.RU.3)
K-2.TV.2 Recognize that apps and devices can change or improve through updates.
Security Controls
K-2.SC.1 Describe the concept of a strong password and its importance.
K-2.SC.2 Describe methods to maintain digital privacy and security when accessing technology (e.g., password, PIN, multi-factor authentication). (Library Media 2.RU.2)

Third - Fifth Grade

Computing Devices and Systems *Learners will develop an understanding of how networks, hardware, and software function and interact, fostering adaptable skills for digital environments.*
Networks and Internet
3-5.NI.1 Recognize that information is sent and received across physical or wireless paths.
3-5.NI.2 Recognize that devices connected to the internet can collect and share data.
3-5.NI.3 Identify locations to store and share information, both offline and online.
Hardware and Software
3-5.HS.1 Use software features and hardware to accomplish a task.
3-5.HS.2 With guidance, apply basic troubleshooting strategies.
3-5.HS.3 With guidance, organize, store, and retrieve digital information efficiently.
Algorithms and Computational Thinking *Learners will develop and apply a basic understanding of algorithms and computational thinking, enhancing problem-solving and critical-thinking skills.*
Developing and Designing Algorithms
3-5.DD.1 Construct a simple algorithm that uses a sequence of instructions.
3-5.DD.2 Create a simple algorithm to solve a problem using coding constructs such as loops, conditionals, functions, or variables.
3-5.DD.3 List examples of loops, conditionals, functions, or variables in daily life.
Analyzing and Problem Solving
3-5.AP.1 Organize collected data to highlight comparisons and support a claim.
3-5.AP.2 Identify and correct errors in algorithms or processes.
3-5.AP.3 *Standard begins in grade 6.*
Impacts of Computing *Learners will understand how technology shapes individuals and the world and influences safety policy, law, and ethics.*
Policies and Laws
3-5.PL.1 With guidance, demonstrate an understanding of copyright and fair use. (Library Media 5.IP.1)
3-5.PL.2 Understand the purpose of and comply with responsible and acceptable use policies. (Library Media 5.RU.1)
3-5.PL.3 *Standard begins in grade 6.*
Ethics
3-5.E.1 Describe motivations that influence the ethical use of technology.
3-5.E.2 With guidance, understand that biases exist and distinguish between facts and opinions in various sources. (Library Media 5.E.1)
Societal Impacts
3-5.S.1 Explain the positive and negative impacts of technology on how people live, work, and interact.
3-5.S.2 Examine how current and emerging technologies impact individuals and local communities.

Third - Fifth Grade

Digital Citizenship *Learners will practice responsible digital consumption, creation, communication, and interaction.*
Digital Well-Being
3-5.DW.1 Identify strategies for media balance. (Library Media 5.RU.5)
3-5.DW.2 Discuss the personal impact of technology use on one's learning and relationships.
Digital Identity
3-5.DI.1 Give examples of how using technology builds one's digital identity. (Library Media 5.DI.1)
Social Interactions
3-5.SI.1 Identify social interactions and how they impact self and others. (Library Media 5.SI.2)
3-5.SI.2 Discuss examples of cyberbullying, the effects on individuals, and age-appropriate prevention and reporting strategies.
Security *To protect individuals and organizations, learners will gain a foundational understanding of safe and best practices for data and system security, including information, network, and physical security.*
Personally Identifiable Information
3-5.PI.1 Identify risks of online sharing of private information (e.g., identity theft, data collection, and personal safety). (Library Media 5.RU.4)
Threats and Vulnerability
3-5.TV.1 Explain how malicious actions (e.g., phishing, malware, clickbait, data collection, and identity theft) threaten data security.
3-5.TV.2 Identify why keeping apps and devices updated is important for functionality and safety.
Security Controls
3-5.SC.1 Define authentication and identify various authentication methods (e.g., passwords, fingerprint or facial recognition, multi-factor authentication).
3-5.SC.2 Use methods to maintain digital privacy and security when accessing technology (e.g., password, PIN, multi-factor authentication). (Library Media 5.RU.2)

Sixth - Eighth Grade

Computing Devices and Systems *Learners will develop an understanding of how networks, hardware, and software function and interact, fostering adaptable skills for digital environments.*
Networks and Internet
6-8.NI.1 Identify and define network connection types (e.g., WIFI, mobile data, ethernet) and how data is cross-shared.
6-8.NI.2 Evaluate the risks and benefits of the Internet of Things devices.
6-8.NI.3 Explain which information should be stored locally versus in the cloud.
Hardware and Software
6-8.HS.1 Select and use software features and hardware to accomplish a task.
6-8.HS.2 Apply basic troubleshooting strategies.
6-8.HS.3 Organize, store, and retrieve digital information efficiently.
Algorithms and Computational Thinking *Learners will develop and apply a basic understanding of algorithms and computational thinking, enhancing problem-solving and critical-thinking skills.*
Developing and Designing Algorithms
6-8.DD.1 Identify patterns and repeated steps in an algorithm, problem, or process.
6-8.DD.2 Identify and explain the purpose of an algorithm, problem, or process components.
6-8.DD.3 Predict the outcome(s) of an algorithm, problem, or process.
Analyzing and Problem Solving
6-8.AP.1 Collect, organize, and analyze data.
6-8.AP.2 Revise and improve algorithms or processes to resolve errors.
6-8.AP.3 Seek feedback from others to refine an algorithm or process.
Impacts of Computing *Learners will understand how technology shapes individuals and the world and influences safety policy, law, and ethics.*
Policies and Laws
6-8.PL.1 Properly use copyrighted works, works in the Creative Commons, and works in the public domain by applying fair use guidelines. (Library Media 8.IP.1)
6-8.PL.2 Understand the purpose of and comply with responsible and acceptable use policies. (Library Media 8.RU.1)
6-8.PL.3 Understand the purpose of specific federal, state, and local laws related to cybersecurity and privacy (e.g., FERPA, CIPA, COPPA, HIPAA).
Ethics
6-8.E.1 Demonstrate ethical behaviors while using technology.
6-8.E.2 Evaluate information sources to identify bias and determine reliability.
Societal Impacts
6-8.S.1 Examine the positive and negative impacts of equitable access to technology.
6-8.S.2 Analyze the global impact of current and emerging technologies.

Sixth - Eighth Grade

Digital Citizenship *Learners will practice responsible digital consumption, creation, communication, and interaction.*
Digital Well-Being
6-8.DW.1 Evaluate personal media usage and apply strategies to create media balance. (Library Media 8.RU.5)
6-8.DW.2 Discuss the potential impact social media use may have on self-identity and overall wellness.
Digital Identity
6-8.DI.1 Evaluate one's digital identity and its impact online and offline. (Library Media 8.DI.1)
Social Interactions
6-8.SI.1 Determine the cause and effect of social interactions on self and others. (Library Media 8.SI.2)
6-8.SI.2 Identify strategies for responding to positive and negative online situations and discuss the impact of responses on individuals. (Library Media 8.SI.3)
Security *To protect individuals and organizations, learners will gain a foundational understanding of safe and best practices for data and system security, including information, network, and physical security.*
Personally Identifiable Information
6-8.PI.1 Evaluate the benefits versus risks of sharing personal information online (e.g., identity theft, data collection, and personal safety). (Library Media 8.RU.4)
Threats and Vulnerability
6-8.TV.1 Use strategies to prevent cybersecurity threats (e.g., phishing, malware, clickbait, data collection, and identity theft). (Library Media 8.RU.3)
6-8.TV.2 Describe how updates maintain the performance and security of apps and devices.
Security Controls
6-8.SC.1 Explain how authentication and authorization methods can protect users.
6-8.SC.2 Use methods to maintain digital privacy and security when accessing technology (e.g., password, PIN, multi-factor authentication). (Library Media 8.RU.2)

Ninth and Tenth Grade

NOTE: The high school standards reflect the basic knowledge and skills learners should have when graduating. Learners who require more advanced standards should follow the NDCTE standards.

Computing Devices and Systems *Learners will develop an understanding of how networks, hardware, and software function and interact, fostering adaptable skills for digital environments.*
Networks and Internet
9-10.NI.1 Identify the advantages and disadvantages of transmitting information over the internet, including speed, reliability, cost, and security.
9-10.NI.2 Analyze the purpose of the Internet of Things.
9-10.NI.3 Identify the advantages and disadvantages of various cloud computing models.
Hardware and Software
9-10.HS.1 Compare and contrast the appropriate device/hardware/software to complete tasks.
9-10.HS.2 Describe basic hardware and software problems using appropriate and accurate terminology.
9-10.HS.3 Compare and contrast a variety of storage options to fit a need.
Algorithms and Computational Thinking *Learners will develop and apply a basic understanding of algorithms and computational thinking, enhancing problem-solving and critical-thinking skills.*
Developing and Designing Algorithms
9-10.DD.1 Recognize, design, and use an algorithm to solve problems across disciplines.
9-10.DD.2 Solve problems by deconstructing into their components.
9-10.DD.3 Examine algorithms for potential inconsistencies or inefficiencies.
Analyzing and Problem Solving
9-10.AP.1 Collect, organize, analyze, and interpret data.
9-10.AP.2 Revise and improve algorithmic or processes across disciplines.
9-10.AP.3 Work collaboratively to generate multiple solutions to a task, discuss each solution's potential benefits and drawbacks, and reach a consensus on the most effective approach.
Impacts of Computing *Learners will understand how technology shapes individuals and the world and influences safety policy, law, and ethics.*
Policies and Laws
9-10.PL.1a Properly use copyrighted works, works in the Creative Commons, and works in the public domain by applying fair use guidelines.
9-10.PL.1b Explain how fair use, Creative Commons, and public domain materials can help or limit sharing ideas and creativity.
9-10.PL.2 Understand the purpose of and comply with responsible and acceptable use policies. (Library Media 10.RU.1)
9-10.PL.3 Explain the importance of understanding specific laws and user agreements about technology.
Ethics
9-10.E.1 Identify and navigate ethical dilemmas related to technology use, including security, privacy, and intellectual property.
9-10.E.2 Evaluate the accuracy, perspective, credibility, and relevance of information, media, data, or other resources. (Library Media 10.E.2)
Societal Impacts
9-10.S.1 Predict how technology may impact the workplace and personal lives.
9-10.S.2 Evaluate the impacts of current and emerging technologies.

Ninth and Tenth Grade

NOTE: The high school standards reflect the basic knowledge and skills learners should have when graduating. Learners who require more advanced standards should follow the NDCTE standards.

Digital Citizenship *Learners will practice responsible digital consumption, creation, communication, and interaction.*
Digital Well-Being
9-10.DW.1 Evaluate personal media usage and apply strategies to create media balance. (Library Media 10.RU.5)
9-10.DW.2 Evaluate the potential benefits and harms social media use may have on self-identity and overall wellness.
Digital Identity
9-10.DI.1 Manage one's digital identity and plan for potential future impacts.
Social Interactions
9-10.SI.1 Use technologies to communicate and collaborate effectively to broaden perspectives and work toward common goals. (Library Media 10.SI.1)
9-10.SI.2 Demonstrate respect and integrity online. (Library Media 10.SI.3)
Security *To protect individuals and organizations, learners will gain a foundational understanding of safe and best practices for data and system security, including information, network, and physical security.*
Personally Identifiable Information
9-10.PI.1 Monitor and manage personal information shared online about oneself and others.
Threats and Vulnerability
9-10.TV.1 Develop strategies to help resolve issues arising from cybersecurity threats.
9-10.TV.2 Differentiate between security updates and feature updates and explain their purposes.
Security Controls
9-10.SC.1 Evaluate the advantages and disadvantages of authentication and authorization methods.
9-10.SC.2 Implement best practices to secure personal information when accessing technology (e.g., password, PIN, multi-factor authentication). (Library Media 10.RU.2)

Eleventh and Twelfth Grade

NOTE: The high school standards reflect the basic knowledge and skills learners should have when graduating. Learners who require more advanced standards should follow the NDCTE standards.

Computing Devices and Systems *Learners will develop an understanding of how networks, hardware, and software function and interact, fostering adaptable skills for digital environments.*
Networks and Internet
11-12.NI.1 Choose an appropriate connection to transmit information based on speed, reliability, cost, and security.
11-12.NI.2 Compare and contrast the benefits and security risks of the Internet of Things.
11-12.NI.3 Appropriately utilize a variety of cloud computing resources to accomplish tasks.
Hardware and Software
11-12.HS.1 Choose the appropriate device/hardware/software to complete tasks and explain the choice.
11-12.HS.2 Implement systematic troubleshooting strategies to identify and fix errors.
11-12.HS.3 Develop personal procedures and policies for utilizing storage needs (e.g., backups).
Algorithms and Computational Thinking *Learners will develop and apply a basic understanding of algorithms and computational thinking, enhancing problem-solving and critical-thinking skills.*
Developing and Designing Algorithms
11-12.DD.1 Use and adapt common algorithms to solve computational problems.
11-12.DD.2 Deconstruct problems into components to create new solutions to existing problems.
11-12.DD.3 Evaluate a variety of algorithms that could be used for similar processes in real-world applications.
Analyzing and Problem Solving
11-12.AP.1 Determine and utilize the most effective method to collect and represent complex data.
11-12.AP.2 Revise and improve algorithms or processes across disciplines.
11-12.AP.3 Work collaboratively to analyze complex problems, develop multiple solutions, evaluate the effectiveness of each solution, and justify the reasoning behind the chosen approach.
Impacts of Computing *Learners will understand how technology shapes individuals and the world and influences safety policy, law, and ethics.*
Policies and Laws
11-12.PL.1a Properly use copyrighted works, works in the Creative Commons, and works in the public domain by applying fair use guidelines.
11-12.PL.1b Explain intellectual property laws' beneficial and harmful effects on innovation, creativity, and collaboration.
11-12.PL.2 Understand the purpose of and comply with responsible and acceptable use policies. (Library Media 12.RU.1)
11-12.PL.3 Explain the importance of understanding specific laws and user agreements about technology.
Ethics
11-12.E.1 Discuss and make personal judgments about the ethical use of technology.
11-12.E.2 Justify source selection based on accuracy, perspective, credibility, and relevance of information, media, data, or other resources. (Library Media 12.E.2)
Societal Impacts
11-12.S.1 Explain how technology may change cultural and environmental aspects of society.
11-12.S.2 Evaluate the impact of equity, bias, access, and influence on current and emerging technologies in a global society.

Eleventh and Twelfth Grade

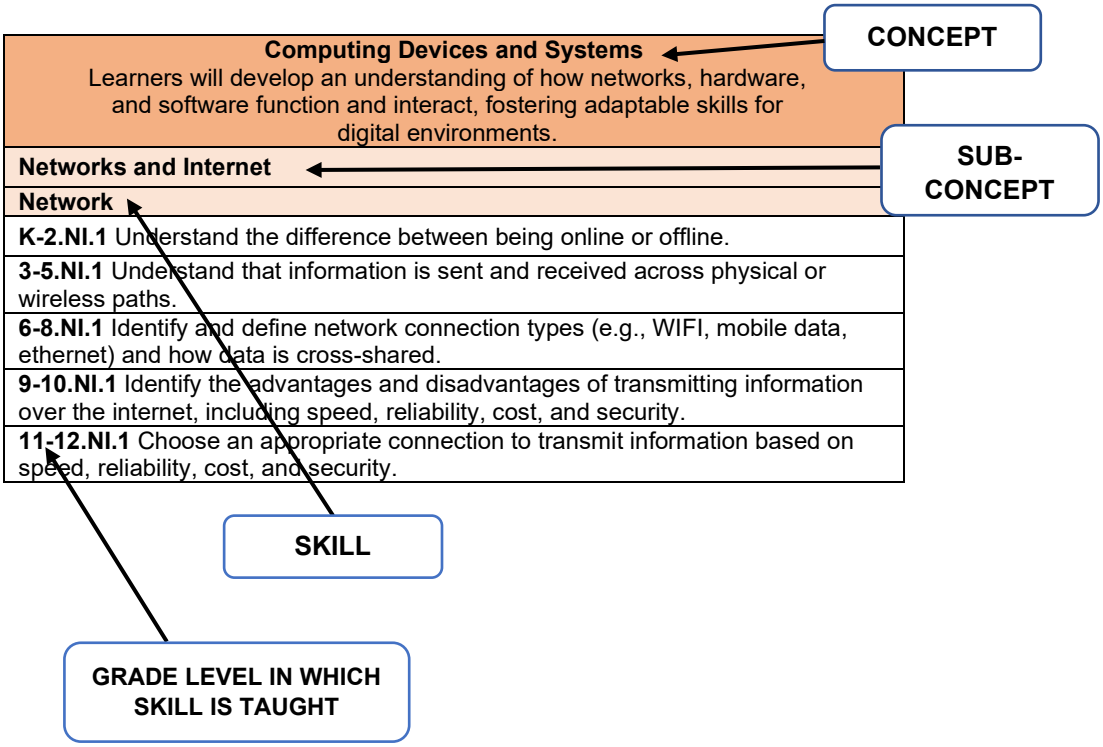
NOTE: The high school standards reflect the basic knowledge and skills learners should have when graduating. Learners who require more advanced standards should follow the NDCTE standards.

Digital Citizenship *Learners will practice responsible digital consumption, creation, communication, and interaction.*
Digital Well-Being
11-12.DW.1 Evaluate personal media usage and apply strategies to create media balance. (Library Media 12.RU.5)
11-12.DW.2 Propose strategies for maintaining a healthy balance in social media usage.
Digital Identity
11-12.DI.1 Evaluate one's digital identity and footprint.
Social Interactions
11-12.SI.1 Use technologies to communicate and collaborate effectively to broader perspectives and work toward common goals. (Library Media 12.SI.1)
11-12.SI.2 Demonstrate respect and integrity online. (Library Media 12.SI.3)
Security *To protect individuals and organizations, learners will gain a foundational understanding of safe and best practices for data and system security, including information, network, and physical security.*
Personally Identifiable Information
11-12.PI.1 Monitor and manage personal information shared online about oneself and others.
Threats and Vulnerability
11-12.TV.1 Develop a sense of self-efficacy that allows one to act on and resolve issues arising from cybersecurity threats.
11-12.TV.2 Analyze and evaluate the urgency of installing updates, considering the differences between security and feature updates
Security Controls
11-12.SC.1 Implement best practices associated with authentication and authorization methods.
11-12.SC.2 Implement best practices to secure personal information when accessing technology (e.g., password, PIN, multifactor authentication). (Library Media 12.RU.2)

K-12 COMPUTER SCIENCE AND CYBERSECURITY CONTENT STANDARDS SKILLS PROGRESSIONS

This section of the standards shows how skills develop over time. It is organized by specific skills.

HOW TO READ THE SKILLS PROGRESSIONS



Computing Devices and Systems Learners will develop an understanding of how networks, hardware, and software function and interact, fostering adaptable skills for digital environments.
Networks and Internet
Network
K-2.NI.1 Understand the difference between being online or offline.
3-5.NI.1 Understand that information is sent and received across physical or wireless paths.
6-8.NI.1 Identify and define network connection types (e.g., WIFI, mobile data, ethernet) and how data is cross-shared.
9-10.NI.1 Identify the advantages and disadvantages of transmitting information over the internet, including speed, reliability, cost, and security.
11-12.NI.1 Choose an appropriate connection to transmit information based on speed, reliability, cost, and security.

Computing Devices and Systems Learners will develop an understanding of how networks, hardware, and software function and interact, fostering adaptable skills for digital environments.
Networks and Internet
Network
K-2.NI.1 Compare the difference between being online and offline.
3-5.NI.1 Recognize that information is sent and received across physical or wireless paths.
6-8.NI.1 Identify and define network connection types (e.g., WIFI, mobile data, ethernet) and how data is cross-shared.
9-10.NI.1 Identify the advantages and disadvantages of transmitting information over the internet, including speed, reliability, cost, and security.
11-12.NI.1 Choose an appropriate connection to transmit information based on speed, reliability, cost, and security.
Internet of Things
K-2.NI.2 Identify devices that can be connected to the internet.
3-5.NI.2 Recognize that devices connected to the internet can collect and share data.
6-8.NI.2 Evaluate the risks and benefits of the Internet of Things devices.
9-10.NI.2 Analyze the purpose of the Internet of Things.
11-12.NI.2 Compare and contrast the benefits and security risks of the Internet of Things.
Storage and Cloud Computing
K-2.NI.3 Identify that information can be stored and shared online.
3-5.NI.3 Identify locations to store and share information, both offline and online.
6-8.NI.3 Explain which information should be stored locally versus the in cloud.
9-10.NI.3 Identify the advantages and disadvantages of various cloud computing models.
11-12.NI.3 Appropriately utilize a variety of cloud computing resources to accomplish tasks.
Hardware and Software
Use, Comparison, and Selection
K-2.HS.1 Use software to accomplish a task.
3-5.HS.1 Use software features and hardware to accomplish a task.
6-8.HS.1 Select and use software features and hardware to accomplish a task.
9-10.HS.1 Compare and contrast the appropriate device/hardware/software to complete tasks.
11-12.HS.1 Choose the appropriate device/hardware/software to complete tasks and explain the choice.
Troubleshooting
K-2.HS.2 Identify the components (e.g., screen, keyboard, mouse, power button) and basic functions of a computing device.
3-5.HS.2 With guidance, apply basic troubleshooting strategies.
6-8.HS.2 Apply basic troubleshooting strategies.
9-10.HS.2 Describe basic hardware and software problems using appropriate and accurate terminology.
11-12.HS.2 Implement systematic troubleshooting strategies to identify and fix errors.
Information Organization, Storage, and Retrieval
K-2.HS.3 Recognize that digital information can be organized, stored, and retrieved.
3-5.HS.3 With guidance, organize, store, and retrieve digital information efficiently.
6-8.HS.3 Organize, store, and retrieve digital information efficiently.
9-10.HS.3 Compare and contrast a variety of storage options to fit a need.
11-12.HS.3 Develop personal procedures and policies for utilizing storage needs (e.g., backups).

Algorithms and Computational Thinking Learners will develop and apply a basic understanding of algorithms and computational thinking, enhancing problem-solving and critical-thinking skills.
Developing and Designing Algorithms
Design and Use of Algorithms
K-2.DD.1 Break a task into smaller steps to identify patterns or solve problems.
3-5.DD.1 Construct a simple algorithm that uses a sequence of instructions.
6-8.DD.1 Identify patterns and repeated steps in an algorithm, problem, or process.
9-10.DD.1 Recognize, design, and use an algorithm to solve problems across disciplines.
11-12.DD.1 Use and adapt common algorithms to solve computational problems.
Components of Algorithms
K-2.DD.2 Create an algorithm that uses a sequence to solve a problem.
3-5.DD.2 Create a simple algorithm to solve a problem using coding constructs such as loops, conditionals, functions, or variables.
6-8.DD.2 Identify and explain the purpose of an algorithm, problem, or process components.
9-10.DD.2 Solve problems by deconstructing into their components.
11-12.DD.2 Deconstruct problems into components to create new solutions to existing problems.
Application and Assessment of Algorithms
K-2.DD.3 Identify examples of patterns and conditionals in daily life.
3-5.DD.3 List examples of loops, conditionals, functions, or variables in daily life.
6-8.DD.3 Predict the outcome(s) of an algorithm, problem, or process.
9-10.DD.3 Examine algorithms for potential inconsistencies or inefficiencies.
11-12.DD.3 Evaluate a variety of algorithms that could be used for similar processes in real-world applications.
Analyzing and Problem Solving
Data Collection and Analysis
K-2.AP.1 Organize collected data to make a prediction with or without a computing device.
3-5.AP.1 Organize collected data to highlight comparisons and support a claim.
6-8.AP.1 Collect, organize, and analyze data.
9-10.AP.1 Collect, organize, analyze, and interpret data.
11-12.AP.1 Determine and utilize the most effective method to collect and represent complex data.
Revising Algorithms and Processes
K-2.AP.2 Identify and correct errors in algorithms or processes.
3-5.AP.2 Identify and correct errors in algorithms or processes.
6-8.AP.2 Revise and improve algorithms or processes to resolve errors.
9-10.AP.2 Revise and improve algorithms or processes across disciplines.
11-12.AP.2 Revise and improve algorithms or processes across disciplines.
Collaborative Problem Solving
Standard begins in grade 6.
6-8.AP.3 Seek feedback from others to refine an algorithm or process.
9-10.AP.3 Work collaboratively to generate multiple solutions to a task, discuss each solution's potential benefits and drawbacks, and reach a consensus on the most effective approach.
11-12.AP.3 Work collaboratively to analyze complex problems, develop multiple solutions, evaluate the effectiveness of each solution, and justify the reasoning behind the chosen approach.

Impacts of Computing Learners will understand how technology shapes individuals and the world and influences safety policy, law, and ethics.
Policies and Laws
Copyright and Fair Use
K-2.PL.1 Demonstrate an understanding that creative works are protected by law. (Library Media 2.IP.1)
3-5.PL.1 With guidance, demonstrate an understanding of copyright and fair use. (Library Media 5.IP.1)
6-8.PL.1 Properly use copyrighted works, works in the Creative Commons, and works in the public domain by applying fair use guidelines. (Library Media 8.IP.1)
9-10.PL.1a Properly use copyrighted works, works in the Creative Commons, and works in the public domain by applying fair use guidelines.
9-10.PL.1b Explain how fair use, Creative Commons, and public domain materials can help or limit sharing ideas and creativity.
11-12.PL.1a Properly use copyrighted works, works in the Creative Commons, and works in the public domain by applying fair use guidelines.
11-12.PL.1b Explain intellectual property laws' beneficial and harmful effects on innovation, creativity, and collaboration.
Responsible and Acceptable Use Policies
K-2.PL.2 Understand the purpose of and comply with responsible and acceptable use policies. (Library Media 2.RU.1)
3-5.PL.2 Understand the purpose of and comply with responsible and acceptable use policies. (Library Media 5.RU.1)
6-8.PL.2 Understand the purpose of and comply with responsible and acceptable use policies. (Library Media 8.RU.1)
9-10.PL.2 Understand the purpose of and comply with responsible and acceptable use policies. (Library Media 10.RU.1)
11-12.PL.2 Understand the purpose of and comply with responsible and acceptable use policies. (Library Media 12.RU.1)
Laws and User Agreements
Standard begins in grade 6.
6-8.PL.3 Understand the purpose of specific federal, state, and local laws related to cybersecurity and privacy (e.g., FERPA, CIPA, COPPA, HIPAA).
9-10.PL.3 Explain the importance of understanding specific laws and user agreements about technology.
11-12.PL.3 Explain the importance of understanding specific laws and user agreements about technology.
Ethics
Ethical Use of Technology
K-2.E.1 Describe the positive and negative uses of technology.
3-5.E.1 Describe motivations that influence the ethical use of technology.
6-8.E.1 Demonstrate ethical behaviors while using technology.
9-10.E.1 Identify and navigate ethical dilemmas related to technology use, including security, privacy, and intellectual property.
11-12.E.1 Discuss and make personal judgments about the ethical use of technology.
Evaluation of Information
K-2.E.2 Identify facts and opinions. (Library Media 2.E.1)
3-5.E.2 With guidance, understand that biases exist and distinguish between facts and opinions in various sources. (Library Media 5.E.1)
6-8.E.2 Evaluate information sources to identify bias and determine reliability.
9-10.E.2 Evaluate the accuracy, perspective, credibility, and relevance of information, media, data, or other resources. (Library Media 10.E.2)
11-12.E.2 Justify source selection based on accuracy, perspective, credibility, and relevance of information, media, data, or other resources. (Library Media 12.E.2)
Societal Impacts
Technological Impacts on Society and Daily Life
K-2.S.1 Identify the positive and negative impacts of technology on how people live, work, and interact.

3-5.S.1 Explain the positive and negative impacts of technology on how people live, work, and interact.
6-8.S.1 Examine the positive and negative impacts of equitable access to technology.
9-10.S.1 Predict how technology may impact the workplace and personal lives.
11-12.S.1 Explain how technology may change cultural and environmental aspects of society.
Impact of Current and Emerging Technologies
K-2.S.2 Identify how current and emerging technologies impact individuals.
3-5.S.2 Examine how current and emerging technologies impact individuals and local communities.
6-8.S.2 Analyze the global impact of current and emerging technologies.
9-10.S.2 Evaluate the impacts of current and emerging technologies.
11-12.S.2 Evaluate the impact of equity, bias, access, and influence on current and emerging technologies in a global society.
Digital Citizenship Learners will practice responsible digital consumption, creation, communication, and interaction.
Digital Well-Being
Balancing Media Usage
K-2.DW.1 Identify appropriate times to use technology and times to be screen-free. (Library Media 2.RU.5)
3-5.DW.1 Identify strategies for media balance. (Library Media 5.RU.5)
6-8.DW.1 Evaluate personal media usage and apply strategies to create media balance. (Library Media 8.RU.5)
9-10.DW.1 Evaluate personal media usage and apply strategies to create media balance. (Library Media 10.RU.5)
11-12.DW.1 Evaluate personal media usage and apply strategies to create media balance. (Library Media 12.RU.5)
Impacts of Technology Use on Self and Others
K-2.DW.2 Discuss the potential impact of technology use on one's learning and relationships.
3-5.DW.2 Discuss the personal impact of technology use on one's learning and relationships.
6-8.DW.2 Discuss the potential impact social media use may have on self-identity and overall wellness.
9-10.DW.2 Evaluate the potential benefits and harms social media use may have on self-identity and overall wellness.
11-12.DW.2 Propose strategies for maintaining a healthy balance in social media usage.
Digital Identity
Digital Identity and Digital Footprint
K-2.DI.1 With guidance, understand that using technology creates a digital footprint.
3-5.DI.1 Give examples of how using technology builds one's digital identity. (Library Media 5.DI.1)
6-8.DI.1 Evaluate one's digital identity and its impact online and offline. (Library Media 8.DI.1)
9-10.DI.1 Manage one's digital identity and plan for potential future impacts.
11-12.DI.1 Evaluate one's digital identity and footprint.
Social interactions
Impact of Social Interactions
K-2.SI.1 Identify social interactions that can impact self and others. (Library Media 2.SI.2)
3-5.SI.1 Identify social interactions and how they impact self and others. (Library Media 5.SI.2)
6-8.SI.1 Determine the cause and effect of social interactions on self and others. (Library Media 8.SI.2)
9-10.SI.1 Use technologies to communicate and collaborate effectively to broaden perspectives and work toward common goals. (Library Media 10.SI.1)
11-12.SI.1 Use technologies to communicate and collaborate effectively to broaden perspectives and work toward common goals. (Library Media 12.SI.1)
Online Behavior
K-2.SI.2 Discuss appropriate online behavior, the effects on individuals, and age-appropriate responses.
3-5.SI.2 Discuss examples of cyberbullying, the effects on individuals, and age-appropriate prevention and reporting strategies.
6-8.SI.2 Identify strategies for responding to positive and negative online situations and discuss the impact of responses on individuals. (Library Media 8.SI.3)
9-10.SI.2 Demonstrate respect and integrity online. (Library Media 10.SI.3)

11-12.SI.2 Demonstrate respect and integrity online. (Library Media 12.SI.3)
Security To protect individuals and organizations, learners will gain a foundational understanding of safe and best practices for data and system security, including information, network, and physical security.
Personally Identifiable Information
Sharing and Managing Personal Information
K-2.PI.1 Identify public versus private information, listing examples of information that needs to be protected.
3-5.PI.1 Identify risks of online sharing of private information (e.g., identity theft, data collection, and personal safety). (Library Media 5.RU.4)
6-8.PI.1 Evaluate the benefits versus risks of sharing personal information online (e.g., identity theft, data collection, and personal safety). (Library Media 8.RU.4)
9-10.PI.1 Monitor and manage personal information shared online about oneself and others.
11-12.PI.1 Monitor and manage personal information shared online about oneself and others.
Threats and Vulnerability
Cybersecurity Threats
K-2.TV.1 Understand that cybersecurity threats exist (e.g., phishing, malware, clickbait). (Library Media 2.RU.3)
3-5.TV.1 Explain how malicious actions (e.g., phishing, malware, clickbait, data collection, and identity theft) threaten data security.
6-8.TV.1 Use strategies to prevent cybersecurity threats (e.g., phishing, malware, clickbait, data collection, and identity theft). (Library Media 8.RU.3)
9-10.TV.1 Develop strategies to help resolve issues arising from cybersecurity threats.
11-12.TV.1 Develop a sense of self-efficacy that allows one to act on and resolve issues arising from cybersecurity threats.
Updating Apps and Devices
K-2.TV.2 Recognize that apps and devices can change or improve through updates.
3-5.TV.2 Identify why keeping apps and devices updated is important for functionality and safety.
6-8.TV.2 Describe how updates maintain the performance and security of apps and devices.
9-10.TV.2 Differentiate between security updates and feature updates and explain their purposes.
11-12.TV.2 Analyze and evaluate the urgency of installing updates, considering the differences between security and feature updates.
Security Controls
Authentication and Authorization
K-2.SC.1 Describe the concept of a strong password and its importance.
3-5.SC.1 Define authentication and identify various authentication methods (e.g. passwords, fingerprint or facial recognition, multi-factor authentication).
6-8.SC.1 Explain how authentication and authorization methods can protect users.
9-10.SC.1 Evaluate the advantages and disadvantages of authentication and authorization methods.
11-12.SC.1 Implement best practices associated with authentication and authorization methods.
Digital Privacy and Security
K-2.SC.2 Describe methods to maintain digital privacy and security when accessing technology (e.g., password, PIN, multi-factor authentication). (Library Media 2.RU.2)
3-5.SC.2 Use methods to maintain digital privacy and security when accessing technology (e.g., password, PIN, multi-factor authentication). (Library Media 5.RU.2)
6-8.SC.2 Use methods to maintain digital privacy and security when accessing technology (e.g., password, PIN, multi-factor authentication). (Library Media 8.RU.2)
9-10.SC.2 Implement best practices to secure personal information when accessing technology (e.g., password, PIN, multi-factor authentication). (Library Media 10.RU.2)
11-12.SC.2 Implement best practices to secure personal information when accessing technology (e.g., password, PIN, multifactor authentication). (Library Media 12.RU.2)

Glossary

acceptable/responsible use policy: a written document approved by an organization outlining terms and conditions for users

algorithm: a process or set of rules to be followed in calculations or other problem-solving operations, especially by a computer

Artificial Intelligence (AI): technology focused on creating systems that perform tasks requiring human-like thought, such as learning, reasoning, and perception

application (app): see software

authentication: the process or action of verifying the identity of a user

authorization: the process of granting or denying access to specific resources or actions based on the identity of a user

bias: preconceived opinion in favor of or against one thing, person, or group compared with another, usually in a way considered to be unfair

clickbait: (on the internet) content whose main purpose is to attract attention and encourage visitors: to click on a link to a particular web page

cloud computing: the delivery of computing services—including storage, processing power, databases, networking, software, and analytics—over the internet (“the cloud”) instead of through local servers or personal devices

computational thinking: a problem-solving method that uses computer science concepts to design systems, solve problems, and understand human behavior

computer science: the study of computers and algorithmic processes, including their principles, hardware and software designs, implementation, and impact on society

conditionals: programming language constructs that allow a computer to perform different actions or return different values based on the value of a Boolean expression, or condition

copyright: legal protection that creators have over the things they create

Creative Commons: a set of various licenses that allow people to share their copyrighted work, be copied, edited, built upon, etc., while retaining the copyright to the original work

cyberbullying: using digital devices, sites, and apps to intimidate, harm repeatedly, and upset someone

cybersecurity: a framework used to protect the integrity of networks, programs, and data from attack, damage, or unauthorized access

data: quantities, characters, or symbols that are the inputs and outputs of computer programs

digital citizenship: the practice of navigating the digital world safely, responsibly, and ethically

digital footprint: the trail of information a person leaves behind online, including data from cookies, search history, and online activity logs

digital identity: the online representation of a person, encompassing all the information about them that exists digitally, including their social media profiles, online activity, and personal details shared online, essentially creating a picture of who they are in the digital world

ethics: moral principles that govern a person's behavior or the conducting of an activity

fair use: ability to use copyrighted work without permission, but only in certain ways and in specific situations

function: a reusable block of code that performs a specific task and can be called with inputs to produce an output

hardware: the physical components that make up a computing system, computer, or computing device

information technology: the study or use of systems (especially computers and telecommunications) for storing, retrieving, and sending information

Internet of Things (IoT): the interconnection via the internet of computing devices embedded in everyday objects, enabling them to send and receive data

loop: a programming structure that repeats a sequence of instructions

malware: software that is specifically designed to disrupt, damage, or gain unauthorized access to a computer system

network: a group of computing devices (personal computers, phones, servers, switches, routers, etc.) connected by cables or wireless media for the exchange of information and resources

offline: refers to a state where a device, system, or user is not connected to a network and cannot communicate or interact with other devices, systems, or users in real time.

online: refers to a state where a device, system, or user is connected to a network, typically the internet, and can communicate or interact with other devices, systems, or users in real time.

patterns: a recurring, recognizable structure or approach used to solve a problem

phishing: the fraudulent practice of sending emails or other messages purporting to be from reputable companies to induce individuals to reveal personal information, such as passwords and credit card numbers

process: a series of actions or steps taken to achieve a particular end

sequence: a set of logical steps carried out in order

software: programs that run on a computing system, computer, or other computing device

technology: the methods, systems, and devices which are the result of scientific knowledge being used for practical purposes

troubleshooting: a systematic approach to problem-solving that is often used to find and resolve a problem, error, or fault within software or a computing system

update: essential for maintaining the security, functionality, and performance of software and systems; help protect against new threats, ensure compatibility with other technologies, and improve overall user experience

variable: a placeholder that is used to keep track of a value that can change while a program is running, the value can be numbers, text, or a logical value