

# By the end of grade 5

## Computing Systems 5.CS

**People interact with a wide variety of computing devices that collect, store, analyze, and act upon information in ways that can affect human capabilities both positively and negatively. The physical components (hardware) and instructions (software) that make up a computing system communicate and process information in digital form.**

- 1 Computing devices may be connected to other devices to form a system as a way to extend their capabilities. 5.CS.1
  1. Model how computing devices connect to other components to form a system. 8.1.5.CS.1
  - 2 Software and hardware work together as a system to accomplish tasks (e.g., sending, receiving, processing, and storing units of information). 5.CS.2
    2. Model how computer software and hardware work together as a system to accomplish tasks. 8.1.5.CS.2
  - 3 Shared features allow for common troubleshooting strategies that can be effective for many systems. 5.CS.3
    3. Identify potential solutions for simple hardware and software problems using common troubleshooting strategies. 8.1.5.CS.3

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## Networks and the Internet 5.NI

**Computing devices typically do not operate in isolation. Networks connect computing devices to share information and resources and are an increasingly integral part of computing. Networks and communication systems provide greater connectivity in the computing world.**

- 1 Information needs a physical or wireless path to travel to be sent and received. 5.NI.1
    1. Develop models that successfully transmit and receive information using both wired and wireless methods. 8.1.5.NI.1
    - 2 Distinguishing between public and private information is important for safe and secure online interactions. Information can be protected using various security measures (i.e., physical and digital). 5.NI.2
      2. Describe physical and digital security measures for protecting sensitive personal information. 8.1.5.NI.2
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## Impacts of Computing 5.IC

**Computing affects many aspects of the world in both positive and negative ways at local, national, and global levels. Individuals and communities influence computing through their behaviors and cultural and social interactions, and, in turn, computing influences new cultural practices.**

- 1 The development and modification of computing technology is driven by people's needs and wants and can affect individuals differently. 5.IC.1
  - 2 Identify possible ways to improve the accessibility and usability of computing technologies to address the diverse needs and wants of users. 8.1.5.IC.2
  - 1 Identify computing technologies that have impacted how individuals live and work and describe the factors that influenced the changes. 8.1.5.IC.1
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## Data & Analysis 5.DA

**Computing systems exist to process data. The amount of digital data generated in the world is rapidly expanding, so the need to process data effectively is increasingly important. Data is collected and stored so that it can be analyzed to better understand the world and make more accurate predictions.**

- 1 Data can be organized, displayed, and presented to highlight relationships 5.DA.1
    1. Collect, organize, and display data in order to highlight relationships or support a claim. 8.1.5.DA.1
  - 2 The type of data being stored affects the storage requirements. 5.DA.2
    2. Compare the amount of storage space required for different types of data. 8.1.5.DA.2
  - 3 Individuals can select, organize, and transform data into different visual representations and communicate insights gained from the data. 5.DA.3
    4. Organize and present climate change data visually to highlight relationships or support a claim. 8.1.5.DA.4
    3. Organize and present collected data visually to communicate insights gained from different views of the data. 8.1.5.DA.3
  - 4 Many factors influence the accuracy of inferences and predictions. 5.DA.4
    5. Propose cause and effect relationships, predict outcomes, or communicate ideas using data. 8.1.5.DA.5
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**An algorithm is a sequence of steps designed to accomplish a specific task. Algorithms are translated into programs, or code, to provide instructions for computing devices. Algorithms and programming control all computing systems, empowering people to communicate with the world in new ways and solve compelling problems.**

- 1 Different algorithms can achieve the same result. Some algorithms are more appropriate for a specific use than others. 5.AP.1
    1. Compare and refine multiple algorithms for the same task and determine which is the most appropriate. 8.1.5.AP.1
  - 2 Programming languages provide variables, which are used to store and modify data. 5.AP.2
    2. Create programs that use clearly named variables to store and modify data. 8.1.5.AP.2
  - 3 A variety of control structures are used to change the flow of program execution (e.g., sequences, events, loops, conditionals). 5.AP.3
    3. Create programs that include sequences, events, loops, and conditionals. 8.1.5.AP.3
  - 4 Programs can be broken down into smaller parts to facilitate their design, implementation, and review. Programs can also be created by incorporating smaller portions of programs that already exist. 5.AP.4
    4. Break down problems into smaller, manageable sub-problems to facilitate program development. 8.1.5.AP.4
    5. Modify, remix, or incorporate pieces of existing programs into one's own work to add additional features or create a new program. 8.1.5.AP.5
  - 5 Individuals develop programs using an iterative process involving design, implementation, testing, and review. 5.AP.5
    6. Develop programs using an iterative process, implement the program design, and test the program to ensure it works as intended 8.1.5.AP.6
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## Engineering Design 5.ED

**People design for enjoyment and to solve problems, extend human capabilities, satisfy needs and wants, and improve the human condition. Engineering Design, a systematic approach to creating solutions to technological problems and finding ways to meet people's needs and desires, allows for the effective and efficient development of products and systems.**

- 1 Engineering design is a systematic and creative process of communicating and collaborating to meet a design challenge. Often, several design solutions exist, each better in some way than the others. 5.ED.1
3. Follow step by step directions to assemble a product or solve a problem, using appropriate tools to accomplish the task. 8.2.5.ED.3
2. Collaborate with peers to collect information, brainstorm to solve a problem, and evaluate all possible solutions to provide the best results with supporting sketches or models. 8.2.5.ED.2
1. Explain the functions of a system and its subsystems. 8.2.5.ED.1
- 2 Engineering design requirements include desired features and limitations that need to be considered. 5.ED.2
6. Evaluate and test alternative solutions to a problem using the constraints and trade-offs identified in the design process. 8.2.5.ED.6
5. Describe how specifications and limitations impact the engineering design process. 8.2.5.ED.5
4. Explain factors that influence the development and function of products and systems (e.g., resources, criteria, desired features, constraints). 8.2.5.ED.4

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## Interaction of Technology and Humans 5.ITH

**Societies influence technological development. Societies are characterized by common elements such as shared values, differentiated roles, and cultural norms, as well as by entities such as community institutions, organizations, and businesses. Interaction of Technology and Humans concerns the ways society drives the improvement and creation of new technologies, and how technologies both serve and change society.**

- 1 Societal needs and wants determine which new tools are developed to address real-world problems. 5.ITH.1
  1. Explain how societal needs and wants influence the development and function of a product and a system. 8.2.5.ITH.1
  - 2 A new tool may have favorable or unfavorable results as well as both positive and negative effects on society. Technology spurs new businesses and careers. 5.ITH.2
  4. Describe a technology/tool that has made the way people live easier or has led to a new business or career. 8.2.5.ITH.4
  3. Analyze the effectiveness of a new product or system and identify the positive and/or negative consequences resulting from its use. 8.2.5.ITH.3
  2. Evaluate how well a new tool has met its intended purpose and identify any shortcomings it might have. 8.2.5.ITH.2
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## Nature of Technology 5.NT

**Human population, patterns and movement focus on the size, composition, distribution, and movement of human populations and how they are fundamental and active features on Earth's surface. This includes understanding that the expansion and redistribution of the human population affects patterns of settlement, environmental changes, and resource use. Patterns and movements of population also relate to physical phenomena including climate variability, landforms, and locations of various natural hazards and their effects on population size, composition, and distribution.**

1. Technology innovation and improvement may be influenced by a variety of factors. Engineers create and modify technologies to meet people's needs and wants; scientists ask questions about the natural world. 5.NT.1
4. Identify how improvement in the understanding of materials science impacts technologies. 8.2.5.NT.4
3. Redesign an existing product for a different purpose in a collaborative team. 8.2.5.NT.3
2. Identify new technologies resulting from the demands, values, and interests of individuals, businesses, industries, and societies. 8.2.5.NT.2
1. Troubleshoot a product that has stopped working and brainstorm ideas to correct the problem. 8.2.5.NT.1

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## Effects of Technology on the Natural World 5.ETNW

**Many of engineering and technology's impacts on society and the environment are widely regarded as desirable. However, other impacts are regarded as less desirable. Effects of Technology on the Natural World concerns the positive and negative ways that technologies affect the natural world.**

1. The technology developed for the human designed world can have unintended consequences for the environment. Technology must be continually developed and made more efficient to reduce the need for nonrenewable resources. 5.ETNW.1
  5. Identify the impact of a specific technology on the environment and determine what can be done to increase positive effects and to reduce any negative effects, such as climate change. 8.2.5.ETW.5
  4. Explain the impact that resources, such as energy and materials used to develop technology, have on the environment. 8.2.5.ETW.4
  3. Explain why human-designed systems, products, and environments need to be constantly monitored, maintained, and improved. 8.2.5.ETW.3
  2. Describe ways that various technologies are used to reduce improper use of resources. 8.2.5.ETW.2
  1. Describe how resources such as material, energy, information, time, tools, people, and capital are used in products or systems. 8.2.5.ETW.1
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## **Ethics & Culture** 5.EC

**Ethics and Culture concerns the profound effects that technologies have on people, how those effects can widen or narrow disparities, and the responsibility that people have for the societal consequences of their technological decisions.**

- 1 Technological choices and opportunities vary due to factors such as differences in economic resources, location, and cultural values. 5.EC.1
  1. Analyze how technology has contributed to or reduced inequities in local and global communities and determine its short- and long-term effects. 8.2.5.EC.1