

Arkansas Computer Science Standards for Grades K-8

(5-8 Document)

2016

Arkansas Computer Science Standards for Grades K-8

Introduction

The Arkansas Computer Science Standards for Grades K-8 provide an introduction to computing concepts that are to be embedded across other content areas and are intended to support what is already being done in the classroom. The standards support critical thinking through the essential skills of computational thinking and algorithmic problem solving. The course strands, content clusters, and content standards are to be taught in an integrated manner, not in isolation. Integration of basic computer science skills and knowledge through practical classroom experiences promote connections to all subject areas and to the real world. Formal assessment of these standards is not required; teachers may monitor and measure student learning through normal classroom activities and interactions.

Implementation of the Arkansas Computer Science Standards for Grades K-8 begins during the 2017-2018 school year.

Computer Science Practices

Students will exhibit proficiency in computer science through:

Perseverance - Students expect and persist in overcoming the challenges that occur when completing tasks. They recognize that making and correcting mistakes will take place during the learning process and problem solving.

Collaboration - Students effectively work and communicate with others ensuring multiple voices are heard and considered. They understand that diverse thoughts may lead to creative solutions and that some problems may be best solved collaboratively.

Patterns - Students understand and utilize the logical structure of information through identifying patterns and creating conceptual models. They decompose complex problems into simpler modules and patterns.

Tools - Students evaluate and select tools to be used when completing tasks and solving problems. They understand that appropriate tools may include, but are not limited to, their mind, pencil and paper, manipulatives, software application programs, programming languages, or appropriate computing devices.

Communication - Students effectively communicate, using accurate and appropriate terminology, when explaining the task completion or problem solving strategies that were used. They recognize that good documentation is an ongoing part of the process, and when appropriate, provide accurate documentation of their work in a manner that is understandable to others.

Ethics and Impact - Students comprehend the ramifications of actions prior to taking them. They are aware of their own digital and cyber presence and its impact on other individuals and society.

Problem Solving - Students exhibit proficiency in Computer Science through identifying and systematically solving problems (e.g., engineering design process). They recognize problem solving as an ongoing process.

**Arkansas Computer Science Standards for Grades K-8
(5-8 Document)**

Strand	Content Cluster
Computational Thinking and Problem Solving	
	1. Students will analyze problem-solving strategies.
	2. Students will analyze connections between elements of mathematics and computer science.
	3. Students will solve problems cooperatively and collaboratively.
Data and Information	
	4. Students will analyze various ways in which data is represented.
	5. Students will collect, arrange, and represent data.
	6. Students will interpret and analyze data and information.
Algorithms and Programs	
	7. Students will create, evaluate, and modify algorithms.
	8. Students will create programs to solve problems.
Computers and Communications	
	9. Students will analyze the utilization of computers.
	10. Students will utilize appropriate digital tools for various applications.
	11. Students will analyze various components and functions of computers.
Community, Global, and Ethical Impacts	
	12. Students will analyze appropriate uses of technology.

Notes for the 5-8 Computer Science Standards document:

1. The examples given (e.g.,) are suggestions to guide the instructor.
2. The course strands, content clusters, and the content standards are to be taught in an integrated manner, not in isolation.
3. The Practices are intended to be habits of mind for all students and were written broadly in order to apply to all grades. The Practices are not content standards and are not intended to be formally assessed but may be assessed formatively.
4. This Arkansas Department of Education curriculum standards document is intended to assist in district curriculum development, unit design, and to provide a uniform, comprehensive guide for instruction.
5. Notes found within the document are not approved by the Arkansas State Board of Education, but are provided for clarification of the standards by the Arkansas Department of Education and/or the standards drafting committee. The notes are subject to change as understandings of the standards evolve.

Strand: Computational Thinking and Problem Solving
 Content Cluster 1: Students will analyze problem-solving strategies.

THE GOAL FOR EACH STUDENT IS PROFICIENCY IN ALL REQUIREMENTS AT CURRENT AND PREVIOUS GRADES.			
Grade 5	Grade 6	Grade 7	Grade 8
CT.1.5.1 Demonstrate basic steps of algorithmic problem solving with or without a computer	CT.1.6.1 Select basic steps to solve algorithmic problems	CT.1.7.1 Evaluate basic steps of algorithmic problem solving to design solutions	CT.1.8.1 Solve algorithmic problems of increasing complexity
<p>Note for CT.1.5.1 through CT.1.8.1 Problems within these standards can be, but are not limited to, real world problems or problems encountered in the student's daily-life. The use of the word algorithm within these standards is applicable to all content areas, not just mathematics. Algorithm within these standards implies a sequence of steps followed when completing a particular task. The steps followed to make a peanut butter and jelly sandwich is an algorithm. Problem solving steps may include, but are not limited to, identifying, stating, and exploring the problem; decomposing a problem into sub problems; examination of sample instances; and solution design, implementation, and testing.</p>			
CT.1.5.2 Begins in Grade 7	CT.1.6.2 Begins in Grade 7	CT.1.7.2 Compare and contrast examples of high level and low level programming languages	CT.1.8.2 Investigate the notion of hierarchy in computing including high level languages, translations, instruction sets, and logic circuits
<p>Note for CT.1.7.2 This intent of this standard is for the student to be provided an introduction to differences between high and low level computer programming languages. The student is not required to write a computer program in high-level and low-level programming languages to meet this standard. Low-level language typically refers to machine code or assembly language, which computers can use without translation. Programs written using high-level languages, such as Java and C++, are closer to human language and must be translated to machine code before a computer can use them.</p>			

Strand: Computational Thinking and Problem Solving

Content Cluster 2: Students will analyze connections between elements of mathematics and computer science.

THE GOAL FOR EACH STUDENT IS PROFICIENCY IN ALL REQUIREMENTS AT CURRENT AND PREVIOUS GRADES.			
Grade 5	Grade 6	Grade 7	Grade 8
CT.2.5.1 Compare and contrast the relative positions of objects using ordered pairs within a program (e.g., battleships, block-based programming, treasure maps)	CT.2.6.1 Ends in Grade 5	CT.2.7.1 Ends in Grade 5	CT.2.8.1 Ends in Grade 5
CT.2.5.2 Begins in Grade 6	CT.2.6.2 Discuss binary numbers, logic, sets, and functions and their application to computer science	CT.2.7.2 Examine binary numbers, logic, sets, and functions and their application to computer science	CT.2.8.2 Evaluate the relationship between binary and hexadecimal representations
CT.2.5.3 Begins in Grade 6	CT.2.6.3 Describe events as subsets of a sample set identifying unions, intersections, and complements (e.g., describing information sorted with a Venn diagram)	CT.2.7.3 Create compound statements that represent unions, intersections, and complements using OR, AND, and NOT (e.g., writing statements from information sorted with a Venn diagram)	CT.2.8.3 Create events as subsets of a sample set using logic (e.g., OR, AND, NOT, NOR, XOR)
CT.2.5.4 Begins in Grade 6	CT.2.6.4 Select variables that appropriately represent data	CT.2.7.4 Construct expressions and equations	CT.2.8.4 Create a function, method, or similar construct with given parameters to be used within a computer program
<p>Note for CT.2.8.4 Any computing device including but not limited to a computer, tablet, or graphing calculator, may be used to meet this standard.</p>			

Strand: Computational Thinking and Problem Solving

Content Cluster 3: Students will solve problems cooperatively and collaboratively.

THE GOAL FOR EACH STUDENT IS PROFICIENCY IN ALL REQUIREMENTS AT CURRENT AND PREVIOUS GRADES.			
Grade 5	Grade 6	Grade 7	Grade 8
<p>CT.3.5.1 Evaluate effective ways that collaboration can support problem solving and innovation</p>	<p>CT.3.6.1 Analyze appropriate collaborative behaviors (e.g., providing useful feedback, integrating feedback, understanding and accepting multiple perspectives, using socialization) to solve problems</p>	<p>CT.3.7.1 Demonstrate appropriate collaborative behaviors (e.g., providing useful feedback, integrating feedback, understanding and accepting multiple perspectives, using socialization) to solve problems</p>	<p>CT.3.8.1 Demonstrate appropriate collaborative behaviors (e.g., providing useful feedback, integrating feedback, understanding and accepting multiple perspectives, using socialization) to solve problems of increasing complexity</p>
<p>Note for CT.3.5.1 through CT.3.8.1 The purpose of this standard is to develop problem solving abilities through collaboration skills, which are necessary within computer science and many other technical fields. The standard does not require the use of a computer program. The educator will determine the preferred student grouping (e.g., whole group, small group, pairs). The problems students are expected to solve may be related to real-life, age appropriate situations they encounter daily.</p>			

Strand: Data and Information

Content Cluster 4: Students will analyze various ways in which data is represented.

THE GOAL FOR EACH STUDENT IS PROFICIENCY IN ALL REQUIREMENTS AT CURRENT AND PREVIOUS GRADES.			
Grade 5	Grade 6	Grade 7	Grade 8
D.4.5.1 Illustrate how different kinds of data can be represented	D.4.6.1 Represent a variety of data in multiple formats	D.4.7.1 Evaluate the effectiveness of visual representations of data	D.4.8.1 Create and analyze data representations of various artifacts
<p>Note for D.4.5.1 through D.4.8.1 Data within these standards may be simple measuring points (e.g., text, sounds, pictures, numbers). These activities may be completed with guidance or within groups.</p>			
D.4.5.2 Recognize that binary is a way of representing data using only two options (e.g., on/off)	D.4.6.2 Discuss how and why binary is used to represent data in a computer	D.4.7.2 Discuss how American Standard Code for Information Interchange (ASCII) codes represent data in a computer	D.4.8.2 Discuss how and why hexadecimal codes are used to represent data in a computer
<p>Note for D.4.5.2 through D.4.8.2 These standards do not require students to understand the machine level language of computers. For example, at Grade 7, a computer does not understand the concept of an upper versus lower-case letter 'F'. A computer distinguishes between the two only because they each have a different ASCII numeral value of 70₁₀ and 102₁₀, respectively.</p>			

Strand: Data and Information

Content Cluster 5: Students will collect, arrange, and represent data.

THE GOAL FOR EACH STUDENT IS PROFICIENCY IN ALL REQUIREMENTS AT CURRENT AND PREVIOUS GRADES.			
Grade 5	Grade 6	Grade 7	Grade 8
D.5.5.1 Evaluate, select, and use appropriate tools to collect data	D.5.6.1 Collect data using a variety of tools (e.g., analog, digital)	D.5.7.1 Collect data from multiple sources using a variety of tools (e.g., analog, digital)	D.5.8.1 Critique data collected from multiple sources using a variety of tools (e.g., analog, digital)
D.5.5.2 Identify the characteristics (e.g., collection environment, units of measure, input method) of the collected data	D.5.6.2 Describe the characteristics (e.g., collection environment, units of measure, input method) of the collected data	D.5.7.2 Analyze the quality of collected data, based on its characteristics (e.g., temperatures gathered at different scale) to determine the value provided to the user	D.5.8.2 Collect data to be used for quality analysis
D.5.5.3 Evaluate the most effective ways to collect, arrange, and visually represent data	D.5.6.3 Evaluate the most effective ways to collect, arrange, and visually represent data	D.5.7.3 Evaluate the most effective ways to collect, arrange, and visually represent data	D.5.8.3 Evaluate the most effective ways to collect, arrange, and visually represent data

Notes for Content Cluster 5

- Though it is suggested when appropriate, there is no requirement for any of the standards within Content Cluster 5 to be taught using a computing device.
- Efforts were made to align these standards with other subject areas including mathematics; however, they are cross-curricular standards and may not align perfectly with any other particular set of standards.

Strand: Data and Information

Content Cluster 6: Students will interpret and analyze data and information.

THE GOAL FOR EACH STUDENT IS PROFICIENCY IN ALL REQUIREMENTS AT CURRENT AND PREVIOUS GRADES.			
Grade 5	Grade 6	Grade 7	Grade 8
D.6.5.1 Explore various models and simulations (e.g., ecosystems, epidemics, molecular dynamics) to support learning and research	D.6.6.1 Compare various problems that can be solved using modeling and simulation	D.6.7.1 Evaluate the effectiveness of a model/simulation with a peer	D.6.8.1 Analyze the degree to which a computer model accurately represents an actual situation
D.6.5.2 Begins in Grade 7	D.6.6.2 Begins in Grade 7	D.6.7.2 Examine techniques for creating models and simulations to be used for data analysis	D.6.8.2 Create a model and/or simulation to be used for data analysis

Note for Content Cluster 6

These standards align closely with standards within other content areas; however, the ability to analyze data and information is essential to the field of computer science. The content within these standards is very similar to content found within the science and math standards at the given grade level, and could easily be integrated into those classes. However, the computer science standards can be integrated into any content area.

Strand: Algorithms and Programs

Content Cluster 7: Students will create, evaluate, and modify algorithms.

THE GOAL FOR EACH STUDENT IS PROFICIENCY IN ALL REQUIREMENTS AT CURRENT AND PREVIOUS GRADES.			
Grade 5	Grade 6	Grade 7	Grade 8
A.7.5.1 Create algorithms to solve a problem	A.7.6.1 Create algorithms to solve problems and evaluate their effectiveness	A.7.7.1 Create algorithms to solve problems and evaluate their effectiveness using constraints (e.g., solution time, maximum number of steps)	A.7.8.1 Create algorithms to solve problems of increasing complexity and evaluate their effectiveness using constraints (e.g., solution time, maximum number of steps)
A.7.5.2 Compare and contrast algorithms of appropriate complexity	A.7.6.2 Compare and contrast algorithms of appropriate complexity	A.7.7.2 Compare and contrast algorithms of appropriate complexity	A.7.8.2 Compare and contrast algorithms of appropriate complexity
A.7.5.3 Identify and correct multiple errors within an algorithm that solves a problem	A.7.6.3 Identify and correct errors within multiple algorithms	A.7.7.3 Identify and correct multiple errors within a program	A.7.8.3 Identify and correct multiple errors within multiple programs
A.7.5.4 Design and test algorithms of appropriate complexity collaboratively	A.7.6.4 Design and test algorithms of appropriate complexity collaboratively	A.7.7.4 Design and test algorithms of appropriate complexity collaboratively	A.7.8.4 Design and test algorithms of appropriate complexity collaboratively using technology

Note for Content Cluster 7

The use of the word algorithm within these standards is applicable to all content areas, not just mathematics. Algorithm within these standards implies a sequence of steps followed when completing a particular task. The steps followed to make a peanut butter and jelly sandwich form an algorithm. These standards may be completed using a computing device but do not require the use of one. Students should be encouraged to find their own solutions in many instances; notwithstanding, the standards do require students to demonstrate the ability to follow and/or correct a specified series of steps when necessary. For instance, students may be asked to indicate whether shoes should be put on before socks, or whether socks should be put on before shoes. For a video explanation of algorithm please visit <http://goo.gl/87ghV9>.

Strand: Algorithms and Programs

Content Cluster 8: Students will create programs to solve problems.

THE GOAL FOR EACH STUDENT IS PROFICIENCY IN ALL REQUIREMENTS AT CURRENT AND PREVIOUS GRADES.			
Grade 5	Grade 6	Grade 7	Grade 8
<p>A.8.5.1 Use a visual block-based and/or text-based programming language individually and collaboratively to solve problems of increasing complexity</p>	<p>A.8.6.1 Use a visual block-based and/or text-based programming language individually and collaboratively to solve problems of increasing complexity</p>	<p>A.8.7.1 Use a visual block-based and/or text-based programming language individually and collaboratively to solve problems of increasing complexity</p>	<p>A.8.8.1 Create a program individually and collaboratively using a text-based programming language</p>
<p>Note for A.8.5.1 through A.8.7.1 These standards may be met by using free online programming environments such as Blockly, Scratch Jr., or Code.org. While the expectation is that students will utilize computers to solve problems with increasing regularity, students may be able to meet these requirements through a program as simple as Code.org's <i>Hour of Code</i>.</p> <p>Note for A.8.8.1 This standard may be met by using a free integrated development environment or other programming environment. This standard can not be met by using a visual block-based programming environment. Nothing within this standard should be taken as a mandate to purchase a particular programming solution.</p>			

Strand: Computers and Communications

Content Cluster 9: Students will analyze the utilization of computers.

THE GOAL FOR EACH STUDENT IS PROFICIENCY IN ALL REQUIREMENTS AT CURRENT AND PREVIOUS GRADES.			
Grade 5	Grade 6	Grade 7	Grade 8
CC.9.5.1 Examine the range and types of careers that require computing and technology	CC.9.6.1 Investigate a career that requires computing and technology	CC.9.7.1 Describe how computer science enhances other career fields	CC.9.8.1 Predict the role of computer science in future careers
CC.9.5.2 Discuss ways that a human creates input for a desired output through a device (e.g., texting, changing device settings)	CC.9.6.2 Identify what distinguishes humans from machines focusing on human intelligence versus machine intelligence (e.g., robot motion, speech and language understanding, and computer vision)	CC.9.7.2 Describe ways in which computers use models of intelligent behavior (e.g., robot motion, speech and language understanding, and computer vision)	CC.9.8.2 Compare and contrast human intelligence and computer intelligence (e.g., emotional decision making versus logical decisions, common sense, literal versus abstract)

Strand: Computers and Communications

Content Cluster 10: Students will utilize appropriate digital tools for various applications.

THE GOAL FOR EACH STUDENT IS PROFICIENCY IN ALL REQUIREMENTS AT CURRENT AND PREVIOUS GRADES.			
Grade 5	Grade 6	Grade 7	Grade 8
CC.10.5.1 Demonstrate an appropriate level of proficiency with keyboards and other input/output devices (e.g., printer, student response systems, texting/instant messaging, voice assist)	CC.10.6.1 Demonstrate an appropriate level of proficiency with keyboards and other input/output devices. (e.g., printer, student response systems, texting/instant messaging, voice assist)	CC.10.7.1 Demonstrate an appropriate level of proficiency with keyboards and other input/output devices. (e.g., printer, student response systems, texting/instant messaging, voice assist)	CC.10.8.1 Demonstrate an appropriate level of proficiency with keyboards and other input/output devices. (e.g., printer, student response systems, texting/instant messaging, voice assist)
CC.10.5.2 Recognize the expense of the equipment, how care and protection of the computers can prolong use and save the cost of purchasing new equipment, therefore benefiting all students	CC.10.6.2 Recognize the expense of the equipment, how care and protection of the computers can prolong use and save the cost of purchasing new equipment, therefore benefiting all students	CC.10.7.2 Recognize the expense of the equipment, how care and protection of the computers can prolong use and save the cost of purchasing new equipment, therefore benefiting all students	CC.10.8.2 Recognize the expense of the equipment, how care and protection of the computers can prolong use and save the cost of purchasing new equipment, therefore benefiting all students
CC.10.5.3 Demonstrate touch typing techniques, not looking at keyboard, while increasing speed and maintaining accuracy	CC.10.6.3 Demonstrate touch typing techniques while increasing speed and maintaining accuracy	CC.10.7.3 Demonstrate touch typing techniques while increasing speed and maintaining accuracy	CC.10.8.3 Demonstrate touch typing techniques while increasing speed and maintaining accuracy
CC.10.5.4 Practice proper keyboarding technique: <ul style="list-style-type: none"> ● posture ● elbows down ● body centered in front of keyboard 	CC.10.6.4 Practice proper keyboarding technique <ul style="list-style-type: none"> ● posture ● elbows down ● body centered in front of keyboard 	CC.10.7.4 Practice proper keyboarding technique <ul style="list-style-type: none"> ● posture ● elbows down ● body centered in front of keyboard 	CC.10.8.4 Practice proper keyboarding technique <ul style="list-style-type: none"> ● posture ● elbows down ● body centered in front of keyboard

Note for Content Cluster 10

Keyboarding is seen as a foundational skill for success in computing and can be taught throughout the curriculum at all grade-levels, through regular classroom projects, with the idea that students will have time to master the skills that they need. The wording of these standards is intentionally flexible in order to allow teachers and districts the ability to differentiate based on student and district needs.

Strand: Computers and Communications

Content Cluster 11: Students will analyze various components and functions of computers.

THE GOAL FOR EACH STUDENT IS PROFICIENCY IN ALL REQUIREMENTS AT CURRENT AND PREVIOUS GRADES.			
Grade 5	Grade 6	Grade 7	Grade 8
CC.11.5.1 Use and evaluate productivity technology tools (e.g., word processing, spreadsheet, presentation software) for effectiveness in writing, communication, and publishing activities	CC.11.6.1 Apply productivity/multimedia tools to support communication throughout the curriculum	CC.11.7.1 Apply productivity/multimedia tools to support communication throughout the curriculum	CC.11.8.1 Design, develop, and publish/present products (e.g., videos, podcasts, websites) using technology resources that demonstrate and communicate curriculum concepts
CC.11.5.2 Identify that information can be transmitted using many computing devices via a network	CC.11.6.2 Describe how information can be transmitted by many computing devices via a network	CC.11.7.2 Identify major components and functions of computer systems and networks	CC.11.8.2 Describe major components and functions of computer systems and networks
CC.11.5.3 Describe the unique features of a variety of computing devices that execute programs using processors (e.g., mobile devices, automobiles, airplanes)	CC.11.6.3 Ends in Grade 5	CC.11.7.3 Ends in Grade 5	CC.11.8.3 Ends in Grade 5
CC.11.5.4 Apply strategies for solving simple hardware and software problems that may occur during use. (e.g., refresh the webpage, restart the device)	CC.11.6.4 Apply strategies for solving simple hardware and software problems that may occur during use	CC.11.7.4 Apply strategies for identifying and solving routine hardware and software problems that occur during everyday computer use	CC.11.8.4 Apply strategies for identifying and solving routine hardware and software problems that occur in everyday computer use

Note for Content Cluster 11

These standards are designed to be met by students using computer programs to complete regular classroom activities such as research projects or typing papers.

Strand: Community, Global, and Ethical Impacts

Content Cluster 12: Students will analyze appropriate uses of technology.

THE GOAL FOR EACH STUDENT IS PROFICIENCY IN ALL REQUIREMENTS AT CURRENT AND PREVIOUS GRADES.			
Grade 5	Grade 6	Grade 7	Grade 8
CGE.12.5.1 Explain positive and negative impact of technology (e.g., mobile computing and communication, web technologies, digital security, virtualization) on the daily life of individuals and society	CGE.12.6.1 Demonstrate an understanding of positive and negative impact of technology (e.g., mobile computing and communication, web technologies, digital security, virtualization) on the daily life of individuals and society	CGE.12.7.1 Analyze changes in technology over time and the effects those changes have on the daily life of individuals and society	CGE.12.8.1 Analyze positive and negative impacts (e.g., workforce, economy, education, culture, environment) of technology on the world
CGE.12.5.2 Demonstrate an understanding of the appropriate use of technology and information and the consequences of inappropriate use	CGE.12.6.2 Discuss the difference between appropriate, legal, and ethical uses of technology	CGE.12.7.2 Demonstrate an understanding between appropriate, legal, and ethical uses of technology	CGE.12.8.2 Analyze the difference between appropriate, legal, and ethical uses of technology
CGE.12.5.3 Compare the credibility, bias, accuracy, and relevance of electronic information sources	CGE.12.6.3 Demonstrate an understanding of the credibility, bias, accuracy, relevance, age appropriateness, and comprehensiveness of electronic information sources	CGE.12.7.3 Evaluate and discuss the credibility, bias, accuracy, relevance, age appropriateness, comprehensiveness, of electronic information sources concerning real-world problems	CGE.12.8.3 Apply strategies for determining the reliability of information found on the Internet
GCE.12.5.4 Demonstrate an understanding of ethical issues in copyright, fair use, and intellectual property in various media (e.g., music, graphics, video, etc.)	GCE.12.6.4 Demonstrate ethical uses in copyright, fair use, and intellectual property in various media (e.g., music, graphics, video, etc.)	GCE.12.7.4 Demonstrate ethical uses in copyright, fair use and intellectual property in various media (e.g., music, graphics, video, etc.)	GCE.12.8.4 Analyze ethical issues that relate to copyright, fair use and intellectual property in various media (e.g., music, graphics, video, etc.)
GCE.12.5.5 Discuss the impact of access to computing resources	GCE.12.6.5 Demonstrate an understanding of the impact of access to computing resources	GCE.12.7.5 Demonstrate an understanding of the impact of access to computing resources on a global economy	GCE.12.8.5 Analyze the impact of the availability to computing resources on accessing critical information

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