



JOY HOFMEISTER

STATE SUPERINTENDENT OF PUBLIC INSTRUCTION
OKLAHOMA STATE DEPARTMENT OF EDUCATION

MEMORANDUM

TO: The Honorable Members of the State Board of Education

FROM: Joy Hofmeister

DATE: March 8, 2018

SUBJECT: Proposed Oklahoma Academic Standards for Computer Science for Consideration of Approval

The State Department of Education is requesting approval of the proposed Oklahoma Academic Standards for Computer Science (OAS-CS).

“The subject matter standards shall be thoroughly reviewed by the State Board every six (6) years according to and in coordination with the existing subject area textbook adoption cycle. After review, the State Board shall adopt any revisions in such subject matter standards deemed necessary to achieve further improvements in the quality of education for the students of this state.” 70 O.S. § 11-103.6a

Computer Science is part of the upcoming textbook adoption cycle and the Oklahoma State Department of Education recognizes the opportunity for Computer Science expectations for students to be clearly communicated for students in grades K-12. These expectations are critical to the 21st century skills our students will be expected to have mastered as they enter the workforce.

LP
attachments

STRUCTURE OF THE OAS-CS

Oklahoma joins only nine other states who have developed K-12 Computer Science standards and only two others who have developed standards that are grade-level specific from Kindergarten through 8th grade. The high school expectations are split into two levels.

- Level 1 standards are expected by all students.
- Level 2 standards provide a more specialized offering of computing concepts that are appropriate for students choosing to specialize in computer science, whether that leads to industry certifications or any number of computing career pathways.

The new standards develop five essential concepts over the K-12 experience. They ensure students will have the opportunity to investigate critical aspects of computing systems, including knowledge of the computational process, understanding of data storage, the transmission of data across networks, and the importance of security and privacy. In addition, students will study the effects and ramifications a digital culture has on our world-wide society. These concepts and their related subconcepts are:

1. Computing Systems
 - a. Devices
 - b. Hardware and Software
 - c. Troubleshooting
2. Networks and the Internet
 - a. Network Communication and Organization
 - b. Cybersecurity
3. Data Analysis
 - a. Storage
 - b. Collection, Visualization, and Transformation
4. Algorithms and Programming
 - a. Variables
 - b. Control
 - c. Modularity
 - d. Program Development
5. Impacts of Computing
 - a. Culture
 - b. Social Interactions
 - c. Safety, Law, and Ethics

The seven practices of the K12 Computer Science Standards are designed to give broad exposure to computing that is needed by every student and are embedded in the grade-level expectations outlined in the Oklahoma Academic Standards for Computer Science. These practices are:

1. Fostering an inclusive computing culture
2. Collaborating around computing
3. Recognizing and defining computational problems
4. Developing and using abstractions
5. Creating computational artifacts
6. Testing and refining computational artifacts
7. Communicating about computing

The Oklahoma Academic Standards for Computer Science are designed to advance student understanding and utilization of these concepts and practices, and allow all Oklahoma students to participate in discussions around and about computing and to work together creating and developing digital products benefitting a global community. Students, through their own evaluations and revisions, will cultivate an environment rich in collaboration and problem solving.

DEVELOPMENT PROCESS

The development process for these proposed standards involved representatives ranging from K-12 educators, district-level leaders, career technology centers, non-profit organizations and higher education. Through public review periods, 79 public comments were received and evaluated by members of the Writing Team leading to a fourth and final draft of the standards.

We want to thank the members of the Executive Committee for their leadership and support:

- **Dr. Kelvin Droegemeier** — Vice President for Research at the University of Oklahoma
- **Michael Carolina** — Executive Director of the Oklahoma Center for the Advancement of Science and Technology
- **Dr. Blayne Mayfield** — Associate Professor of Computer Science at Oklahoma State University
- **Ms. Pat St. Clair** — Computer Science Educator in Edmond Public Schools

The standards writing process was led by Computer Science educators who very competently guided the development and review of these standards.

- **Hallie Hughes** — Director of Secondary Education at Durant Public Schools
- **Dr. Deborah Trytten** — Associate Professor of Computer Science at the University of Oklahoma

The members of our Writing Team produced invaluable analyses of recommendations from the Computer Science Teachers Associations, the K12 Computer Science Framework, and existing standards from other states. Without their expertise and considerable dedication to the effort, we would not have standards to present today.

K-5 Team

Brad Dishman — Elementary Technology Teacher at Owasso Public Schools
Carol Goodgame — Program Manager for Junior Botball
Laura Sessions — Curriculum Director at Calumet Public Schools
Lisa Fouts — Technology Instructor at Piedmont Public Schools
Dr. Roger Mailler — Associate Professor of Computer Science at the University of Tulsa
Lead Facilitator > **Pat St. Clair**

6-8 Team

Kitty Herbel — Discovering Technology Teacher at Enid Public Schools
Jennifer Ingram — Secondary Curriculum and Instructional Technology Coach at Deer Creek Public Schools
Rebecca Brandon — STEM Teacher at Choctaw Public Schools
Steve Goodgame — Executive Director of the KISS Institute for Practical Robotics
Suzanne Giddens — Computer Teacher at Jenks Public Schools
Lead Facilitator > **Dr. Deborah Trytten**

9-12 Team

Adam Carr — Computer Science Teacher at Bridge Creek Public Schools
Douglas Keely — CTE BMITE Instructor at Stroud Public Schools
Kim Smith — Mobile Apps Development Instructor at Tulsa Technology Center

Pamela Smith — Computer Science Teacher at Jenks Public Schools
Dr. Eric Chan-Tin — Associate Professor of Computer Science at Oklahoma State University
Lead Facilitator > **Hallie Hughes**

Finally, the critical work of carefully analyzing the standards to ensure they are clear, grade-level appropriate, specific but not prescriptive, measurable, and coherent across the grade bands came from our Draft Review Team.

Draft Review Team Members

Anissa Angier — K-12 STEM Instructional Facilitator at Edmond Public Schools

Jenny Chartney — 4th Grade Math Teacher at Edmond Public Schools

Robin Coffman — Curriculum Director at Elk City Public Schools

Vickie Crossley — Technology Teacher at Newcastle Public Schools

Dr. Theresa Cullen — Associate Professor of Instructional Psychology and Technology at the University of Oklahoma

Edith Dishman — K-5 Technology Teacher at Owasso Public Schools

Susan James — Computer Science Teacher at Edmond Public Schools

Ann Linder — Technology Teacher at Owasso Public Schools

Lindsay McCarter — Computer Teacher at Tishomingo Public Schools

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Cassie Ricks — CTE BMITE Teacher at Oklahoma City Public Schools

Beatrice (Bea) Roberson — Computer Science Teacher at Pryor Public Schools

Victor Rook — Computer Science Teacher at Moore Public Schools

Dr. Dale Schoenefeld — Professor of Computer Science and Mathematics at the University of Tulsa

Kim Stone — Business/Technology Teacher at Dibble Public Schools

Akram Taghavi-Burris — Instructor of Computer Simulation and Gaming at the University of Tulsa

Oklahoma Academic Standards for Computer Science {Grades K-2}

Concept	Subconcept	Kindergarten	1st Grade	2nd Grade
Computing Systems	Devices	K.CS.D.01 With guidance, follow directions and start to make appropriate choices to use computing devices to perform a variety of tasks.	1.CS.D.01 With guidance, select and use a computing device to perform a variety of tasks for an intended outcome.	2.CS.D.01 Select and use a computing device to perform a variety of tasks for an intended outcome.
	Hardware & Software	K.CS.HS.01 Use appropriate terminology to locate and identify common computing devices and components, in a variety of environments (e.g., desktop computer, laptop computer, tablet device, monitor, keyboard, mouse, printer).	1.CS.HS.01 Use appropriate terminology in naming and describing the function of common computing devices and components (e.g., mouse is used to control the cursor).	2.CS.HS.01 Identify the components of a computer system and what the basic functions are (e.g., hard drive and memory) as well as peripherals (e.g., printers, scanners, external hard drives) and external storage features and their uses (e.g., cloud storage).
	Troubleshooting	K.CS.T.01 Recognize that computing systems might not work as expected and with guidance use accurate terminology to identify simple hardware or software problems (e.g., volume turned down on headphones, monitor turned off).	1.CS.T.01 Identify, using accurate terminology, simple hardware and software problems that may occur during use (e.g., app or program is not working as expected, no sound is coming from the device, caps lock turned on).	2.CS.T.01 Identify using accurate terminology, simple hardware and software problems that may occur during use (e.g., app or program is not working as expected, no sound is coming from the device, caps lock turned on) and discuss problems with peers and adults.
Networks & The Internet	Network Communication & Organization	K.NI.NCO.01 Recognize that computing devices can be connected together.	1.NI.NCO.01 Recognize that by connecting computing devices together they can share information (e.g., remote storage, printing, the internet).	2.NI.NCO.01 Recognize that computing devices can be connected at various scales (e.g., bluetooth, WiFi, WWW, LAN, WAN, peer-to-peer).
	Cybersecurity	K.NI.C.01 Discuss what passwords are and why we do not share them with others. With guidance, use passwords to access technological devices, apps, etc.	1.NI.C.01 Identify what passwords are; explain why they are not shared; and discuss what makes a password strong. Independently, use passwords to access technological devices, apps, etc.	2.NI.C.01 Explain what passwords are; why we use them, and use strong passwords to protect devices and information from unauthorized access.
Data Analysis	Storage	K.DA.S.01 With guidance, locate, open, modify and save an existing file with a computing device.	1.DA.S.01 With guidance locate, open, modify and save an existing file, use appropriate file-naming conventions, and recognize that the file exists within an organizational structure (drive, folder, file).	2.DA.S.01 With guidance, develop and modify an organizational structure by creating, copying, moving, and deleting files and folders.
	Collection, Visualization, & Transformation	K.DA.CVT.01 With guidance, collect data and present it visually.	1.DA.CVT.01 With guidance, collect data and present it two different ways.	2.DA.CVT.01 With guidance, collect and present the same data in various visual formats. Please make final changes to the standard based on feedback.
	Inference & Models	K.DA.IM.01 With guidance, draw conclusions and make predictions based on picture graphs or patterns (e.g., make predictions based on weather data presented in a picture graph or complete a pattern).	1.DA.IM.01 With guidance, identify and interpret data from a chart or graph (visualization) in order to make a prediction, with or without a computing device.	2.DA.IM.01 With guidance, construct and interpret data and present it in a chart or graph (visualization) in order to make a prediction, with or without a computing device.

Oklahoma Academic Standards for Computer Science {Grades K-2}

Concept	Subconcept	Kindergarten	1st Grade	2nd Grade
Algorithms & Programming	Algorithms	K.AP.A.01 With guidance, model daily processes and follow algorithms (sets of step-by-step instructions) to complete tasks verbally, kinesthetically, with robot devices, or a programming language.	1.AP.A.01 With guidance, model daily processes and follow algorithms (sets of step-by-step instructions) to complete tasks verbally, kinesthetically, with robot devices, or a programming language.	2.AP.A.01 With guidance, model daily processes by creating and following algorithms (sets of step-by-step instructions) to complete tasks verbally, kinesthetically, with robot devices, or a programming language.
	Variables	K.AP.V.01 With guidance, recognize that computers represent different types of data using numbers or other symbols.	1.AP.V.01 With guidance, model the way that a program accesses stored data using a variable name.	2.AP.V.01 Model the way a computer program stores, accesses, and manipulates data that is represented as a variable.
	Control	K.AP.C.01 With guidance, independently or collaboratively create programs to accomplish tasks using a programming language, robot device, or unplugged activity that includes sequencing (i.e., emphasizing the beginning, middle, and end).	1.AP.C.01 With guidance, independently or collaboratively create programs to accomplish tasks using a programming language, robot device, or unplugged activity that includes sequencing and repetition.	2.AP.C.01 With guidance, independently and collaboratively create programs to accomplish tasks using a programming language, robot device, or unplugged activity that includes sequencing and repetition.
	Program Development	K.AP.PD.01 With guidance, create a grade-level appropriate artifact to illustrate thoughts, ideas, or stories in a sequential (step-by-step) manner (e.g., story map, storyboard, and sequential graphic organizer).	1.AP.PD.01 Independently or with guidance, create a grade-level appropriate artifact to illustrate thoughts, ideas, or stories in a sequential (step-by-step) manner (e.g., story map, storyboard, and sequential graphic organizer).	2.AP.PD.01 Independently or with guidance, create a grade-level appropriate artifact to illustrate thoughts, ideas, or stories in a sequential (step-by-step) manner (e.g., story map, storyboard, and sequential graphic organizer).
		K.AP.PD.02 Independently or with guidance give credit to ideas, creations and solutions of others while developing algorithms.	1.AP.PD.02 Independently or with guidance give credit to ideas, creations and solutions of others while writing and/or developing programs.	2.AP.PD.02 Give credit to ideas, creations and solutions of others while writing and developing programs.
		K.AP.PD.03 With guidance, independently or collaboratively debug algorithms using a programming language and/or unplugged activity that includes sequencing.	1.AP.PD.03 With guidance, independently or collaboratively debug programs using a programming language and/or unplugged activity that includes sequencing and repetition.	2.AP.PD.03 With guidance, independently and collaboratively debug programs using a programming language and/or unplugged activity that includes sequencing and repetition.
		K.AP.PD.04 Use correct terminology (beginning, middle, end) in the development of an algorithm to solve a simple problem.	1.AP.PD.04 Use correct terminology (first, second, third) and explain the choices made in the development of an algorithm to solve a simple problem.	2.AP.PD.04 Use correct terminology (debug, program input/output, code) to explain the development of an algorithm to solve a problem in an unplugged activity, hands on manipulatives, or a programming language.
Impacts of Computing	Culture	K.IC.C.01 List different ways in which types of technologies are used in your daily life.	1.IC.C.01 Identify how people use different types of technologies in their daily work and personal lives.	2.IC.C.01 Identify and describe how people use different types of technologies in their daily work and personal lives.
	Social Interactions	K.IC.SI.01 With guidance, identify appropriate manners while participating in an online environment.	1.IC.SI.01 With guidance, identify appropriate and inappropriate behavior. Act responsibly while participating in an online community and know how to report concerns.	2.IC.SI.01 Develop a code of conduct, explain, and practice grade-level appropriate behavior and responsibilities while participating in an online community. Identify and report inappropriate behavior.

Oklahoma Academic Standards for Computer Science {Grades 3-5}

Concept	Subconcept	3rd Grade	4th Grade	5th Grade
Computing Systems	Hardware & Software	3.CS.HS.01 Model how information flows through hardware and software to accomplish tasks.	4.CS.HS.01 Model that information is translated, transmitted, and processed in order to flow through hardware and software.	5.CS.HS.01 Model that information is translated into bits in order to transmit and process between software to accomplish tasks.
	Troubleshooting	3.CS.T.01 Identify, using accurate terminology, simple hardware and software problems that may occur during everyday use, discuss problems with peers and adults, and apply strategies for solving these problems (e.g., refresh the screen, closing and reopening an application or file, unmuting or adjusting the volume on headphones).	4.CS.T.01 Identify, using accurate terminology, simple hardware and software problems that may occur during everyday use, discuss problems with peers and adults, and apply strategies for solving these problems (e.g., rebooting the device, checking the power, force shut down of an application).	5.CS.T.01 Identify, using accurate terminology, simple hardware and software problems that may occur during everyday use. Discuss problems with peers and adults, apply strategies for solving these problems and explain why the strategy should work.
Networks & The Internet	Network Communication & Organization	3.NI.NCO.01 Recognize that information is sent and received over physical or wireless paths.	4.NI.NCO.01 Explain how information is sent and received across physical or wireless paths. (It is broken down into smaller pieces called packets and transmitted from one location to another.)	5.NI.NCO.01 Model how information is broken down into packets (smaller pieces) and transmitted through multiple devices over networks and the Internet, and reassembled at the destination.
	Cybersecurity	3.NI.C.01 Identify problems that relate to inappropriate use of computing devices and networks.	4.NI.C.01 Identify and explain issues related to responsible use of technology and information, and describe personal consequences of inappropriate use.	5.NI.C.01 Discuss real-world cybersecurity problems and identify strategies for how personal information can be protected.
Data Analysis	Storage	3.DA.S.01 Recognize that different types of information are stored in different formats that have associated programs (i.e., documents open in a word processor) and varied storage requirements.	4.DA.S.01 Choose different storage locations (physical, shared, or cloud) based on the type of file, storage requirements (file size, availability, available memory), and sharing requirements.	5.DA.S.01 Evaluate trade-offs, including availability and quality, based on the type of file, storage requirements (file size, availability, available memory), and sharing requirements.
	Collection, Visualization, & Transformation	3.DA.CVT.01 Collect and organize data in various visual formats.	4.DA.CVT.01 Organize and present collected data visually to highlight comparisons.	5.DA.CVT.01 Organize and present collected data to highlight comparisons and support a claim.
	Inference & Models	3.DA.IM.01 With guidance, utilize data to make predictions and discuss whether there is adequate data to make reliable predictions.	4.DA.IM.01 Determine how the accuracy of conclusions are influenced by the amount of data collected.	5.DA.IM.01 Use data to highlight or propose cause and effect relationships, predict outcomes, or communicate an idea.

Oklahoma Academic Standards for Computer Science {Grades 3-5}

Concept	Subconcept	3rd Grade	4th Grade	5th Grade
Algorithms & Programming	Algorithms	3.AP.A.01 Compare multiple algorithms for the same task.	4.AP.A.01 Compare and refine multiple algorithms for the same task.	5.AP.A.01 Compare and refine multiple algorithms for the same task and determine which is the most efficient.
	Variables	3.A.V.01 Create programs that use variables to store and modify grade level appropriate data.	4.AP.V.01 Create programs that use variables to store and modify grade level appropriate data.	5.AP.V.01 Create programs that use variables to store and modify grade level appropriate data.
	Control	3.AP.C.01 Create programs using a programming language that utilize sequencing, repetition, conditionals, and variables to solve a problem or express ideas both independently and collaboratively.	4.AP.C.01 Create programs using a programming language that utilize sequencing, repetition, conditionals and variables using math operations manipulate values to solve a problem or express ideas both independently and collaboratively.	5.AP.C.01 Create programs using a programming language that utilize sequencing, repetition, conditionals, event handlers and variables using math operations to manipulate values to solve a problem or express ideas both independently and collaboratively.
	Modularity	3.AP.M.01 Decompose (break down) the steps needed to solve a problem into a precise sequence of instructions.	4.AP.M.01 Decompose (break down) large problems into smaller, manageable subproblems to facilitate the program development process.	5.AP.M.01 Decompose (break down) large problems into smaller, manageable subproblems and then into a precise sequence of instructions.
		3.AP.M.02 With grade appropriate complexity, modify, remix, or incorporate portions of an existing program into one's own work, to develop something new or add more advanced features.	4.AP.M.02 With grade appropriate complexity, modify, remix, or incorporate portions of an existing program into one's own work, to develop something new or add more advanced features.	5.AP.M.02 With grade appropriate complexity, modify, remix, or incorporate portions of an existing program into one's own work, to develop something new or add more advanced features.
	Program Development	3.AP.PD.01 Use an iterative process to plan the development of a program while solving simple problems.	4.AP.PD.01 Use an iterative process to plan the development of a program that includes user preferences while solving simple problems.	5.AP.PD.01 Use an iterative process to plan the development of a program that includes others' perspectives and user preferences while solving simple problems.
		3.AP.PD.02 Observe intellectual property rights and give appropriate credit when creating or remixing programs.	4.AP.PD.02 Observe intellectual property rights and give appropriate credit when creating or remixing programs.	5.AP.PD.02 Observe intellectual property rights and give appropriate credit when creating or remixing programs.
		3.AP.PD.03 Analyze and debug a program that includes sequencing, repetition and variables in a programming language.	4.AP.PD.03 Analyze, create, and debug a program that includes sequencing, repetition, conditionals and variables in a programming language.	5.AP.PD.03 Analyze, create, and debug a program that includes sequencing, repetition, conditionals and variables in a programming language.

Oklahoma Academic Standards for Computer Science {Grades 3-5}

Concept	Subconcept	3rd Grade	4th Grade	5th Grade
		3.AP.PD.04 Communicate and explain your program development using comments, presentations and demonstrations.	4.AP.PD.04 Communicate and explain your program development using comments, presentations and demonstrations.	5.AP.PD.04 Communicate and explain your program development using comments, presentations and demonstrations.
Impacts of Computing	Culture	3.IC.C.01 Identify computing technologies that have changed the world, and express how those technologies influence, and are influenced by, cultural practices.	4.IC.C.01 Give examples of computing technologies that have changed the world, and express how those technologies influence, and are influenced by, cultural practices.	5.IC.C.01 Give examples and explain how computing technologies have changed the world, and express how computing technologies influence, and are influenced by, cultural practices.
		3.IC.C.02 Identify possible problems and how computing devices have built in features for increasing accessibility to all users.	4.IC.C.02 Brainstorm problems and ways to improve computing devices to increase accessibility to all users.	5.IC.C.02 Develop, test and refine digital artifacts to improve accessibility and usability.
	Social Interactions	3.IC.SI.01 Develop a code of conduct, explain, and practice grade-level appropriate behavior and responsibilities while participating in an online community. Identify and report inappropriate behavior.	4.IC.SI.01 Develop a code of conduct, explain, and practice grade-level appropriate behavior and responsibilities while participating in an online community. Identify and report inappropriate behavior.	5.IC.SI.01 Develop a code of conduct, explain, and practice grade-level appropriate behavior and responsibilities while participating in an online community. Identify and report inappropriate behavior.
		3.IC.SI.02 Identify how computational products may be, or have been, improved to incorporate diverse perspectives.	4.IC.SI.02 As a team, consider each others perspectives on improving a computational product.	5.IC.SI.02 As a team, collaborate with outside resources (other grade levels, online collaborative spaces) to include diverse perspectives to improve computational products.
	Safety, Law, & Ethics	3.IC.SLE.01 Identify types of digital data that may have intellectual property rights that prevent copying or require attribution.	4.IC.SLE.01 Discuss the social impact of violating intellectual property rights.	5.IC.SLE.01 Observe intellectual property rights and give appropriate credit when using resources.

Oklahoma Academic Standards for Computer Science {Grades 6-8}

Concept	Subconcept	6th Grade	7th Grade	8th Grade
Computing Systems	Devices	6.CS.D.01 Evaluate existing computing devices and recommend improvements to design based on analysis of personal interaction with the device.	7.CS.D.01 Evaluate existing computing devices and recommend improvements to design based on analysis of how other users interact with the device.	8.CS.D.01 Develop and implement a process to evaluate existing computing devices and recommend improvements to design based on analysis of how other users interact with the device.
	Hardware & Software	6.CS.HS.01 Identify ways that hardware and software are combined to collect and exchange data.	7.CS.HS.01 Evaluate and recommend improvements to software and hardware combinations used to collect and exchange data.	8.CS.HS.01 Design and refine projects that combine hardware and software components to collect and exchange data.
	Troubleshooting	6.CS.T.01 Identify increasingly complex software and hardware problems with computing devices and their components.	7.CS.T.01 Identify and fix increasingly complex software and hardware problems with computing devices and their components.	8.CS.T.01 Systematically identify, fix, and document increasingly complex software and hardware problems with computing devices and their components.
Networks & The Internet	Network Communication & Organization	6.NI.NCO.01 Model a simple protocol for transferring information using packets.	7.NI.NCO.01 Explain how a system responds when a packet is lost and the effect it has on the transferred information.	8.NI.NCO.01 Explain protocols and their importance to data transmission; model how packets are broken down into smaller pieces and how they are delivered.
	Cybersecurity	6.NI.C.01 Identify existing cybersecurity concerns with the Internet and systems it uses.	7.NI.C.01 Explain how to protect electronic information, both physical (e.g. hard drive) and digital, identify cybersecurity concerns and options to address issues with the Internet and the systems it uses.	8.NI.C.01 Evaluate physical and digital procedures that could be implemented to protect electronic data/information; explain the impacts of hacking, ransomware, scams, fake scans, and ethical/legal concerns.
		6.NI.C.02 Explain the importance of secured websites and describe how one method of encryption works.	7.NI.C.02 Identify and explain two or more methods of encryption used to ensure and secure the transmission of information.	8.NI.C.02 Compare the advantages and disadvantages of multiple methods of encryption to model the secure transmission of information.
Data Analysis	Storage	6.DA.S.01 Identify how the same data can be represented in multiple ways.	7.DA.S.01 Create multiple representations of data.	8.DA.S.01 Analyze multiple methods of representing data and choose the most appropriate method for representing data.
	Collection, Visualization, & Transformation	6.DA.CVT.01 Collect data using computational tools and transform the data to make it more useful.	7.DA.CVT.01 Collect data using computational tools and transform the data to make it more useful and reliable.	8.DA.CVT.01 Develop, implement, and refine a process that utilizes computational tools to collect and transform data to make it more useful and reliable.

Oklahoma Academic Standards for Computer Science {Grades 6-8}

Concept	Subconcept	6th Grade	7th Grade	8th Grade
D	Inference & Models	6.DA.IM.01 Use models and simulations to formulate, refine, and test hypotheses.	7.DA.IM.01 Discuss the correctness of a model representing a system by comparing the model's generated results with observed data from the modeled system.	8.DA.IM.01 Refine computational models based on the data generated by the models.
	Algorithms & Programming	Algorithms	6.AP.A.01 Use an existing algorithm in natural language or pseudocode to solve complex problems.	7.AP.A.01 Select and modify an existing algorithm in natural language or pseudocode to solve complex problems.
Control		6.AP.C.01 Develop programs that utilize combinations of repetition, conditionals, and the manipulation of variables representing different data types.	7.AP.C.01 Develop programs that utilize combinations of repetition, compound conditionals, and the manipulation of variables representing different data types.	8.AP.C.01 Develop programs that utilize combinations of nested repetition, compound conditionals, procedures without parameters, and the manipulation of variables representing different data types.
Modularity		6.AP.M.01 Decompose problems into parts to facilitate the design, implementation, and review of programs.	7.AP.M.01 Decompose problems into parts to facilitate the design, implementation, and review of increasingly complex programs.	8.AP.M.01 Decompose problems and subproblems into parts to facilitate the design, implementation, and review of complex programs.
Program Development		6.AP.PD.01 Seek and incorporate feedback from team members to refine a solution to a problem.	7.AP.PD.01 Seek and incorporate feedback from team members and users to refine a solution to a problem.	8.AP.PD.01 Seek and incorporate feedback from team members and users to refine a solution to a problem that meets the needs of diverse users.
		6.AP.PD.02 Incorporate existing code, media, and libraries into original programs and give attribution.	7.AP.PD.02 Incorporate existing code, media, and libraries into original programs of increasing complexity and give attribution.	8.AP.PD.02 Incorporate existing code, media, and libraries into original programs of increasing complexity and give attribution.
		6.AP.PD.03 Test and refine programs using teacher provided inputs.	7.AP.PD.03 Test and refine programs using a variety of student created inputs.	8.AP.PD.03 Systematically test and refine programs using a range of student created inputs.
		6.AP.PD.04 Break down tasks and follow an individual timeline when developing a computational artifact.	7.AP.PD.04 Distribute tasks and maintain a project timeline when collaboratively developing computational artifacts.	8.AP.PD.04 Explain how effective communication between participants is required for successful collaboration when developing computational artifacts.
	6.AP.PD.05 Document text-based programs in order to make them easier to follow, test, and debug.	7.AP.PD.05 Document text-based programs of increasing complexity in order to make them easier to follow, test, and debug.	8.AP.PD.05 Document text-based programs of increasing complexity in order to make them easier to follow, test, and debug.	

Oklahoma Academic Standards for Computer Science {Grades 6-8}

Concept	Subconcept	6th Grade	7th Grade	8th Grade
Impacts of Computing	Culture	6.IC.C.01 Explain how computing impacts people's' everyday activities.	7.IC.C.01 Explain how computing impacts innovation in other fields.	8.IC.C.01 Describe the trade-offs associated with computing technologies (e.g. automation), explaining their effects on economies and global societies, and explore careers related to the field of computer science.
		6.IC.C.02 Identify and discuss the technology proficiencies needed in the classroom and the workplace, and how to meet the needs of diverse users.	7.IC.C.02 Relate the distribution of computing resources in a global society to issues of equity, access, and power.	8.IC.C.02 Evaluate and improve the design of existing technologies to meet the needs of diverse users and increase accessibility and usability. Evaluate how technology can be used to distort, exaggerate, and misrepresent information.
	Social Interactions	6.IC.SI.01 Individually and collaboratively develop and conduct an online survey that seeks input from a broad audience. Describe and use safe, appropriate, and responsible practices (netiquette) when participating in online communities (e.g., discussion groups, blogs, social networking sites).	7.IC.SI.01 Individually and collaboratively use advanced tools to design and create online content (e.g., digital portfolio, multimedia, blog, web page). Describe and use safe, appropriate, and responsible practices (netiquette) when participating in online communities (e.g., discussion groups, blogs, social networking sites).	8.IC.SI.01 Communicate and publish key ideas and details individually or collaboratively in a way that informs, persuades, and/or entertains using a variety of digital tools and media-rich resources. Describe and use safe, appropriate, and responsible practices (netiquette) when participating in online communities (e.g., discussion groups, blogs, social networking sites).
	Safety, Law, & Ethics	6.IC.SLE.01 Differentiate between appropriate and inappropriate content on the Internet, and identify unethical and illegal online behavior.	7.IC.SLE.01 Explain the connection between the longevity of data on the Internet, personal online identity, and personal privacy.	8.IC.SLE.01 Discuss the social impacts and ethical considerations associated with cybersecurity, including the positive and malicious purposes of hacking.

Oklahoma Academic Standards for Computer Science {High School}

Concept	Subconcept	Level 1 - By the end of 10th Grade	Level 2 - By the end of 12th Grade
Computing Systems	Devices	L1.CS.D.01 Explain how abstractions hide the underlying implementation details of computing systems embedded in everyday objects.	
	Hardware & Software	L1.CS.HS.01 Explain the interactions between application software, system software, and hardware.	L2.CS.HS.01 Identify and categorize roles of an operating system.
	Troubleshooting	L1.CS.T.01 Develop and apply criteria for systematic discovery of errors and systematic strategies for correction of errors in computing systems.	L2.CS.T.01 Identify how hardware components facilitate logic, input, output, and storage in computing systems.
Networks & The Internet	Network Communication & Organization	L1.NI.NCO.01 Evaluate the scalability and reliability of networks by identifying and illustrating the basic components of computer networks (e.g., routers, switches, servers, etc.) and network protocols (e.g., IP, DNS, etc.).	L2.NI.NCO.01 Describe the issues that impact network functionality (e.g., bandwidth, load, latency, topology).
	Cybersecurity	L1.NI.C.01 Compare physical and cybersecurity measures by evaluating trade-offs between the usability and security of a computing system.	L2.NI.C.01 Compare and refine ways in which software developers protect devices and information from unauthorized access.
		L1.NI.C.02 Illustrate how sensitive data can be affected by attacks.	
		L1.NI.C.03 Recommend security measures to address various scenarios based on information security principles.	
	L1.NI.C.04 Explain trade-offs when selecting and implementing cybersecurity recommendations from multiple perspectives such as the user, enterprise, and government.		

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Concept	Subconcept	Level 1 - By the end of 10th Grade	Level 2 - By the end of 12th Grade
Data Analysis	Storage	L1.DA.S.01 Translate and compare different bit representations of data types, such as characters, numbers, and images.	
		L1.DA.S.02 Evaluate the trade-offs in how data is organized and stored digitally.	
	Collection, Visualization, & Transformation	L1.DA.CVT.01 Use tools and techniques to locate, collect, and create visualizations of small- and large-scale data sets (e.g., paper surveys and online data sets).	L2.DA.CVT.01 Use data analysis tools and techniques to identify patterns from complex real-world data.
			L2.DA.CVT.02 Generate data sets that use a variety of data collection tools and analysis techniques to support a claim and/or communicate information.
Inference & Models	L1.DA.IM.01 Show the relationships between collected data elements using computational models.	L2.DA.IM.01 Use models and simulations to help formulate, refine, and test scientific hypotheses.	
Algorithms	Algorithms	L1.AP.A.01 Create a prototype that uses algorithms (e.g., searching, sorting, finding shortest distance) to provide a possible solution for a real-world problem.	L2.AP.A.01 Describe how artificial intelligence algorithms drive many software and physical systems (e.g., autonomous robots, computer vision, pattern recognition, text analysis).
			L2.AP.A.02 Develop an artificial intelligence algorithm to play a game against a human opponent or solve a real-world problem.
			L2.AP.A.03 Critically examine and trace classic algorithms (e.g., selection sort, insertion sort, binary search, linear search).

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Concept	Subconcept	Level 1 - By the end of 10th Grade	Level 2 - By the end of 12th Grade
Algorithms & Programming			L2.AP.A.04 Evaluate algorithms (e.g., sorting, searching) in terms of their efficiency and clarity.
	Variables	L1.AP.V.01 Demonstrate the use of lists (e.g., arrays) to simplify solutions, generalizing computational problems instead of repeatedly using primitive variables.	L2.AP.V.01 Compare and contrast simple data structures and their uses (e.g., lists, stacks, queues).
	Control	L1.AP.C.01 Justify the selection of specific control structures (e.g., sequence, conditionals, repetition, procedures) considering program efficiencies such as readability, performance, and memory usage.	L2.AP.C.01 Trace the execution of repetition (e.g., loops, recursion), illustrating output and changes in values of named variables.
	Modularity	L1.AP.M.01 Break down a solution into procedures using systematic analysis and design.	L2.AP.M.01 Construct solutions to problems using student-created components (e.g., procedures, modules, objects).
		L1.AP.M.02 Create computational artifacts by systematically organizing, manipulating and/or processing data.	L2.AP.M.02 Design or redesign a solution to a large-scale computational problem by identifying generalizable patterns.
			L2.AP.M.03 Create programming solutions by reusing existing code (e.g., libraries, Application Programming Interface (APIs), code repositories).
		L1.AP.PD.01 Create software by analyzing a problem and/or process, developing and documenting a solution, testing outcomes, and adapting the program for a variety of users.	L2.AP.PD.01 Create software that will provide solutions to a variety of users using the software life cycle process.
		L1.AP.PD.02 Define and classify a variety of software licensing schemes (e.g., open source, freeware, commercial) and discuss the advantages and disadvantages of each scheme in software development.	L2.AP.PD.02 Design software in a project team environment using integrated development environments (IDEs), versioning systems, and collaboration systems.

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Concept	Subconcept	Level 1 - By the end of 10th Grade	Level 2 - By the end of 12th Grade	
of Computing	Program Development	L1.AP.PD.03 While working in a team, develop, test, and refine event-based programs that solve practical problems or allow self expression.	L2.AP.PD.03 Develop programs for multiple computing platforms.	
		L1.AP.PD.04 Using visual aids and documentation, illustrate the design elements and data flow (e.g., flowcharts, pseudocode) of the development of a complex program.	L2.AP.PD.04 Systematically check code for correctness, usability, readability, efficiency, portability, and scalability through peer review.	
		L1.AP.PD.05 Evaluate and refine computational artifacts to make them more user-friendly, efficient and/or accessible.	L2.AP.PD.05 Develop and use a series of test cases to verify that a program performs according to its design specifications.	
			L2.AP.PD.06 Explain security issues that might lead to compromised computer programs.	
		L2.AP.PD.07 Modify an existing program to add additional functionality and discuss intended and unintended implications (e.g., breaking other functionality).		
	of Computing	Culture	L1.IC.C.01 Evaluate the ways computing impacts personal, ethical, social, economic, and cultural practices.	L2.IC.C.01 Evaluate the beneficial and harmful effects that computational artifacts and innovations have on society.
			L1.IC.C.02 Test and refine computational artifacts to reduce bias and equity deficits.	L2.IC.C.02 Evaluate the impact of equity, access, and influence on the distribution of computing resources in a global society.
L1.IC.C.03 Demonstrate how a given algorithm applies to problems across disciplines.			L2.IC.C.03 Design and implement a study that evaluates or predicts how computation has revolutionized an aspect of our culture and how it might evolve (e.g., education, healthcare, art/entertainment, energy).	
Social Interactions		L1.IC.SI.01 Demonstrate how computing increases connectivity among people of various cultures.		

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Concept	Subconcept	Level 1 - By the end of 10th Grade	Level 2 - By the end of 12th Grade
Impacts	Safety, Law, & Ethics	L1.IC.SLE.01 Explain the beneficial and harmful effects that intellectual property laws can have on innovation.	L2.IC.SLE.01 Debate laws and regulations that impact the development and use of software.
		L1.IC.SLE.02 Explain the privacy concerns related to the large-scale collection and analysis of information about individuals (e.g., how businesses, social media, and the government collects and uses data) that may not be evident to users.	
		L1.IC.SLE.03 Evaluate the social and economic consequences of how law and ethics interact with digital aspects of privacy, data, property, information, and identity.	