

Kentucky Academic Standards (KAS) for Computer Science

Elementary (K-5) Computer Science Standards

Concept: **Networks and The Internet**

Identifier	Standard & Description
E-NI-01	<p>Understand the basic components of how networks operate to protect physical and digital information.</p> <p>Students should be able to articulate that usernames and passwords are used to verify the identity of a person using a computing device or system. Students should use usernames and passwords regularly; be able to show that strong passwords are more secure than weak passwords and longer passwords are stronger than short passwords; indicate that passwords can be made even stronger when numbers and symbols are used as well as letters; and be introduced to the term "complex" as a synonym for "strong."</p> <p>Subconcept: Network Communication & Organization</p> <p><u>Grade-by-Grade Indicators:</u></p> <p><i>K - Describe how usernames and passwords protect personal information.</i></p> <p><i>1 - Demonstrate how to log in and log out of digital device using age appropriate usernames and passwords.</i></p> <p><i>2 - Describe the characteristics of a strong password.</i></p> <p><i>3 - Explain the effects of password misuse.</i></p> <p><i>4 - Explain how acceptable use policies help protect physical devices and digital information.</i></p> <p><i>5 - Demonstrate an understanding of digital security (i.e. use strong passwords; use usernames; protect personal digital information)</i></p>
E-NI-02	<p>Model how information is broken down into smaller pieces (data packets), transmitted over various paths (physical and/or wireless), and reassembled at the destination</p> <p>Computers break down information into smaller pieces called packets, which are sent independently and reassembled at the destination. Students should demonstrate their understanding of this flow of information by: drawing a model of the way packets are transmitted, programming an animation to show how packets are transmitted, or demonstrating this through an analog, non-digital activity which has them act it out in some way (this can also be referred to as an "unplugged activity").</p> <p>Subconcept: Cybersecurity</p>



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	<p><u>Grade-by-Grade Indicators:</u></p> <p><i>K - Not introduced until 4th grade</i></p> <p><i>1 - Not introduced until 4th grade</i></p> <p><i>2 - Not introduced until 4th grade</i></p> <p><i>3 - Not introduced until 4th grade</i></p> <p><i>4 - Describe how computers break down information.</i></p> <p><i>5 - Use a model to represent how digital information is sent and received over physical or wireless paths.</i></p>

Concept: **Data and Analysis**

Identifier	Standard & Description
	<p>Appropriately store and modify digital files.</p> <p>All information stored and processed by a computing device is referred to as data. Data can be images, text documents, audio files, software programs or apps, video files, etc. As students use software to complete tasks on a computing device, they should demonstrate their understand that they are manipulating data.</p>
E-DA-01	<p>Subconcept: Storage</p> <p><u>Grade-by-Grade Indicators:</u></p> <p><i>K - Open and close digital files with prompting and support.</i></p> <p><i>1 - Open, close and save digital files with prompting and support.</i></p> <p><i>2 - Open, close and save digital files.</i></p> <p><i>3 - Search, modify and delete digital files with prompting and support.</i></p> <p><i>4 - Search, modify, and delete digital files.</i></p> <p><i>5 - Convert digital files.</i></p>
	<p>Collect and visually display data using appropriate applications.</p> <p>The collection and use of data about the world around them is a routine part of life and influences how people live. Students should collect data that they experience in the world around them, then organize the data into two or more visualizations. Data collection and analysis should be cross-curricular and occur throughout the year.</p>
E-DA-02	<p>Subconcept: Collection, Visualization & Transformation</p> <p><u>Grade-by-Grade Indicators:</u></p> <p><i>K - Not introduced until 1st Grade.</i></p> <p><i>1 - Ask questions to collect and visually represent data with prompting and support.</i></p> <p><i>2 - Collect and visually represent data using one digital format with prompting and support.</i></p> <p><i>3 - Collect and visually represent data in tables or graphical displays using one application or digital format.</i></p> <p><i>4 - Collect data and determine an appropriate application or format to visually display</i></p>



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	<p><i>the data.</i></p> <p><i>5 - Collect and represent data in graphical displays using one or more application to determine the benefits of using more than one visual display type.</i></p>
	<p>Analyze data for trends and relationships</p> <p>Raw data has little meaning on its own. Students should be able to demonstrate sorting or grouping of data to provide additional clarity and meaning. Organizing data can make interpreting and communicating data to others easier. Data points can be clustered by a number of commonalities. Students should demonstrate understanding that the same data could be manipulated in different ways to emphasize particular aspects or parts of the data set. Raw data should be used to highlight relationships, and to determine different cause and effect relationships. Students can also demonstrate that data can be used to predict things that would happen in the future.</p>
E-DA-03	<p>Subconcept: Inference & Models</p> <p><u>Grade-by-Grade Indicators:</u></p> <p><i>K - Use observations to describe patterns in organized data with prompting and support.</i></p> <p><i>1 - Use observations to describe patterns in organized data.</i></p> <p><i>2 - Use observations to describe patterns that can be predicted in organized data.</i></p> <p><i>3 - Analyze and interpret data using digital tools.</i></p> <p><i>4 - Analyze and interpret data to describe patterns using digital tools.</i></p> <p><i>5 - Represent data in graphical displays and describe cause and effect relationships, communicate ideas or predict outcomes.</i></p>

Concept: **Algorithms and Programming**

Identifier	Standard & Description
	<p>Create, follow, compare and refine algorithms for a task.</p> <p>Algorithms (step-by-step instructions) are common in many primary classrooms. Just as people use algorithms to complete daily routines, they can program computers to use algorithms to complete different tasks. Algorithms are commonly implemented using a precise language that computers can interpret. Different algorithms can be used to perform the same task. While the end results may be similar, the paths may be different. Students should be able to look at different ways to solve the same task and decide which would be the best solution. Algorithms can be expressed in non-computer languages, including natural language, flowcharts, and pseudocode.</p>
E-AP-01	<p>Subconcept: Algorithms</p> <p><u>Grade-by-Grade Indicators:</u></p> <p><i>K - Use simple algorithms to complete everyday tasks.</i></p> <p><i>1 - Create and use simple algorithms to complete everyday tasks.</i></p> <p><i>2 - Create and use simple algorithms using images, text or visual programming blocks</i></p>



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to complete everyday tasks.

3 - Compare two sets of algorithms for the same task to determine the best solution.

4 - Create and compare two sets of algorithms for the same task to determine the best solution.

5 - Modify a set of algorithms and discuss how multiple paths can lead to the same solution.

Explore and use variables in a program.

Information in the real world can be represented in computer programs. Additionally, different actions are available for different kinds of information. Students should demonstrate the understanding that variables are not just used for numbers; they can also hold text, including whole sentences (strings) or logical values (true or false). Students should also demonstrate that a variable has a data type and is associated with a data storage location.

E-AP-02

Subconcept: Variables

Grade-by-Grade Indicators:

K - Describe ways people represent data.

1 - Explain how numbers are used to represent data.

2 - Create a simple model to show how a computer stores information using numbers or symbols.

3 - Identify ways variables are used in programs.

4 - Modify or remix an existing program that uses a variable.

5 - Create a program that uses a variable.

Routinely create programs using a variety of tools to express ideas, address a problem or create an artifact, individually and collaboratively.

Programming is used as a tool to create products that reflect a wide range of interests, including to solve a problem, express an idea or create an artifact. People work together to plan, create and test programs within a context that is relevant to the programmer and those who will use the program. When creating programs, students need to have opportunities to work both individually and with peers. For young learners, collaboration through programming should be encouraged. Student should begin exploring the use of simple sequences and simple loops in Kindergarten and progress to using more complex sequences, loops, events, variables and conditionals by 5th grade.

E-AP-03

Subconcept: Control

Grade-by-Grade Indicators:

K - Routinely create simple programs, independently OR collaboratively.

1 - Routinely create simple programs, independently AND collaboratively.

2 - Routinely create simple programs with sequences using a variety of tools, independently and collaboratively.

3 - Routinely create simple programs with sequences or events using a variety of tools, independently and collaboratively.



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4 - Routinely create simple programs with sequences, events or loops routinely using a variety of tools, independently and collaboratively.

5 - Routinely create simple programs with sequences, events, loops, variables or conditionals routinely using a variety of tools, independently and collaboratively.

Decompose precise steps needed to solve a problem.

Decomposition is the act of breaking down tasks into smaller tasks. Smaller tasks or sub parts (steps that can be broken down into smaller steps) may be broken down even further. The process of decomposition assists in areas of program development by enabling different people to work on different parts at the same time. Students should demonstrate the process of decomposition by enabling different people to work on different parts of program development at the same time.

E-AP-04

Subconcept: Modularity

Grade-by-Grade Indicators:

K - Generate the steps needed to solve a simple problem with prompting and support.

1 - Generate the steps needed to solve a simple problem.

2 - Generate and correctly order the steps needed to solve a simple problem.

3 - Generate and correctly order the steps needed to solve a complex problem.

4 - Decompose a problem into parts to facilitate program development.

5 - Decompose a problem into parts and subparts to facilitate program development.

Use a process when creating programs or computational artifacts.

Students demonstrate the use of formal and informal processes for creating computational artifacts or programs include processes to: ask, imagine, plan, create, test and improve, share; or a creative thinking spiral (i.e. imagine, create, play, share, reflect); and design thinking (empathize, define, ideate, prototype, test). Students demonstrate understanding that these processes are iterative: designed for students to cycle through more than once in order to improve or modify the design and reach the best possible result.

E-AP-05

Subconcept: Modularity

Grade-by-Grade Indicators:

K - Use a process when creating simple programs, individually OR collaboratively, with prompting and support.

1 - Use a process to create simple programs, individually AND collaboratively, with prompting and support.

2 - Use a process to create simple programs that include sequences.

3 - Use a process to create programs that include sequences and events.

4 - Use a process to create programs that includes loops, sequences or events.

5 - Use a process to create programs that include loops, sequences, events, variables or conditions.



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Modify, remix or reuse part of an existing program to create a new program, giving attribution to others.

The design of a new program often involves existing code or remixing other programs within a community (a group of people who share and provide feedback on another's creations). Students should credit the original creator when remixing a program or when ideas are borrowed and iterated upon. Students should also consider common licenses that place limitations or restrictions on the use of computational artifacts such as images and music downloaded from the Internet. At this stage, attribution should be written in the format required by the teacher and should always be included on any programs shared online.

E-AP-06

Subconcept: Program Development

Grade-by-Grade Indicators:

K - Not introduced until 3rd grade

1 - Not introduced until 3rd grade

2 - Not introduced until 3rd grade

3 - Modify or add features to an existing program, with prompting and support, to create a new program, giving attribution.

4 - Modify, remix or reuse parts of an existing program to create a new program, giving attribution.

5 - Modify, remix, reuse parts or add features to an existing program to create a new program, giving attribution.

Document, share and reflect when creating programs using correct terminology.

Documentation of the design process allows students and others to better understand a program. In addition, students need to have opportunities to discuss, share and receive feedback from peers and adults when creating and refining projects. Students should be using correct, age-appropriate terminology when sharing their ideas both verbally and written.

Subconcept: Program Development

E-AP-07

Grade-by-Grade Indicators:

K - Document simple programs, using pictures, in order to share process with others.

1 - Document simple programs, using pictures, in order to share with others and reflect on the process.

2 - Document simple programs, with pictures and/or text, to share with others and reflect on the process.

3 - Document programs and discuss development process with peers.

4 - Document programs and discuss development process with peers, using correct terminology.

5 - Document programs using correct terminology and incorporate peer feedback in the development process.



Identifier	Standard & Description
	<p>Identify and correct errors in an algorithm.</p> <p>Debugging is the process of isolating and correcting "bugs" in a program. As part of the debugging process, students demonstrate the importance of determining if the program is fixable (What happened? What was supposed to happen? What does this tell you? Is it fixable?). Students demonstrate use of an iterative process (repeating steps to improve desired result) when programming aids in the detection and isolation of programming errors.</p>
E-AP-08	<p>Subconcept: Program Development</p> <p><u>Grade-by-Grade Indicators:</u></p> <p><i>K - Analyze and debug simple algorithms with prompting and support.</i></p> <p><i>1 - Analyze and debug simple algorithms which includes sequencing.</i></p> <p><i>2 - Analyze and debug algorithms which includes simple loops.</i></p> <p><i>3 - Analyze and debug algorithms which includes sequencing and loops.</i></p> <p><i>4 - Analyze and debug algorithms which includes sequencing, loops and events.</i></p> <p><i>5 - Analyze and debug algorithms which includes sequencing, loops, events and conditionals.</i></p>

Concept: **Impacts of Computing**

Identifier	Standard & Description
	<p>Discuss how computing has impacted society.</p> <p>Students demonstrate an understanding that computing technology has positively and negatively changed the way people live and work.</p> <p>Subconcept: Culture</p> <p><u>Grade-by-Grade Indicators:</u></p> <p><i>K - Make observations to describe ways computing devices are used daily life.</i></p> <p><i>1 - Describe computing devices used in different careers.</i></p> <p><i>2 - Demonstrate how some tasks can be completed with or without a computing device.</i></p> <p><i>3 - Describe how computing technology impacts the way people live, work, and interact.</i></p> <p><i>4 - Compare and contrast how computing has changed society from the past to the present.</i></p> <p><i>5 - Describe the positive and negative impacts of computing on society.</i></p>
E-IC-01	
	<p>Discover how computing devices have affected the way people communicate.</p> <p>Computing provides the possibility for constantly connected communications. Students</p>
E-IC-02	



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demonstrate an understanding of communications when connected and disconnected. Students also demonstrate collaboration and the sharing of ideas to allow the benefit of diverse perspectives while also demonstrating collaboration using technology can be synchronous (occurring at the same time) or asynchronous (not occurring at the same time).

Subconcept: Social Interactions

Grade-by-Grade Indicators:

K - Describe different computing devices used for communication.

1 - Describe ways people can communicate using computing devices.

2 - Compare similarities and differences between in person and online communications.

3 - Describe ways in which computing devices could be made more accessible to all users.

4 - Use online collaborative spaces ethically and safely to work with other students to solve a problem or reach a goal.

5 - Compare diverse perspectives, synchronously or asynchronously, to improve a project.

Evaluate the relevance and appropriateness of electronic information sources and digital media.

Students should consider who owns digital sources they wish to use. Students should develop an understanding that while technology makes it easy to share digital media and electronic information sources, it is important to follow the rules of using other people's work and give attribution. Knowledge of specific copyright laws are not expected at this level.

Subconcept: Safety, Law & Ethics

E-IC-03

Grade-by-Grade Indicators:

K - Describe characteristics of a website, with prompting and support.

1 - Describe the purpose of different websites, with prompting and support.

2 - Use and cite sources from approved digital materials.

3 - Describe the relevance and appropriateness of various electronic information sources and digital media.

4 - Compare the relevance and appropriateness of various electronic information sources and digital media.

5 - Use relevant and appropriate electronic information sources and digital media, citing resources, for various tasks.

Understand the importance of proper use of data and information in a computing society.

E-IC-04

Online communication facilitates positive and negative interactions; consequently, it is important to protect our data, devices and the information stored on them. Students demonstrate the importance of using data properly including what, how, when, and



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with whom to share.

Subconcept: Safety, Law & Ethics

Grade-by-Grade Indicators:

- K - Describe characteristics of private information.*
- 1 - Identify harmful behaviors when using a connected device.*
- 2 - Demonstrate appropriate behavior when sending messages online.*
- 3 - Describe positive qualities of a digital citizen.*
- 4 - Describe potential strategies to manage and eliminate cyberbullying.*
- 5 - Understand consequences for sending or receiving inappropriate content.*

Concept: **Computing Systems**

Identifier	Standard & Description
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Identify, select and operate appropriate software and hardware to perform a variety of tasks and recognize that users have different needs and preferences for the technology they use.

People use computing devices to perform a variety of tasks accurately and quickly. Students should be able to use the appropriate app/program/software for tasks they are required to complete. Students should be able to successfully use designated hardware device(s) for appropriate programs.

Subconcept: Devices

E-CS-01

Grade-by-Grade Indicators:

- K - Describe ways people use digital devices to perform tasks.*
- 1 - Use the appropriate device and application or software to complete a given task, with prompting and support.*
- 2 - Describe and use the appropriate device and application or software to complete a given task.*
- 3 - Compare and contrast various types and functions of software or applications.*
- 4 - Describe the capabilities and limitations of various software and applications for a particular use.*
- 5 - Justify selection of a particular computing device based on a desired application or task.*

Identify and describe the function of common physical components of computing systems (hardware) using appropriate terminology.

E-CS-02

A computing system is composed of hardware and software. Hardware consists of physical components. While software consists of programs and other operating information used by the computing system or computer. Students should be able to identify and describe the function of external hardware.



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	<p>Subconcept: Hardware & Software</p> <p><u>Grade-by-Grade Indicators:</u></p> <p><i>K - Use appropriate terminology to identify basic hardware.</i></p> <p><i>1 - Use appropriate terminology to identify basic software.</i></p> <p><i>2 - Describe the function of common hardware and software.</i></p> <p><i>3 - Compare and contrast features of different digital devices.</i></p> <p><i>4 - Describe the capabilities and limitations of various digital devices.</i></p> <p><i>5 - Describe the function of major hardware components of a digital device.</i></p>
	<p>Describe basic hardware and software problems using accurate terminology.</p> <p>Problems with computing systems have different causes. Students should demonstrate the ability to communicate a computing system problem with accurate terminology and begin to form an understanding of possible causes.</p> <p>Subconcept: Troubleshooting</p>
E-CS-03	<p><u>Grade-by-Grade Indicators:</u></p> <p><i>K - Identify a simple hardware problem.</i></p> <p><i>1 - Describe simple hardware and software problems.</i></p> <p><i>2 - Use observations to distinguish between simple hardware and software problems.</i></p> <p><i>3 - Demonstrate common troubleshooting strategies to solve simple hardware and software problems.</i></p> <p><i>4 - Describe the causes of hardware, software and connectivity problems.</i></p> <p><i>5 - Demonstrate an appropriate response to various error messages and identify the component and/or application causing the error.</i></p>

