Curriculum Framework
PLTW Launch – 4th Grade – Input/Output: Computer Systems

Desired Results *(stage 1)*

Standards

Computer Science Teachers Association K-12 CS Standards

- 1B-CS-01 Describe how internal and external parts of computing devices function to form a system.
- 1B-CS-02 Model how computer hardware and software work together as a system to accomplish tasks.
- 1B-NI-04 Model how information is broken down into smaller pieces, transmitted as packets through multiple devices over networks and the Internet, and reassembled at the destination.
- 1B-NI-05 Discuss real-world cybersecurity problems and how personal information can be protected.
- 1B-DA-06 Organize and present collected data visually to highlight relationships and support a claim.
- 1B-DA-07 Use data to highlight or propose cause-and-effect relationships, predict outcomes, or communicate an idea.
- 1B-AP-09 Create programs that use variables to store and modify data.
- 1B-AP-10 Create programs that include sequences, events, loops, and conditionals.
- 1B-AP-11 Decompose (break down) problems into smaller, manageable subproblems to facilitate the program development process.
- 1B-AP-13 Use an iterative process to plan the development of a program by including others'

Transfer

Students will be able to independently use their learning to…

T1 – Apply general understanding of computer systems to make sense of human-made machines.
T2 – Apply technology to solve age-appropriate challenges by creating digital artifacts such as games or tools.
T3 – Develop efficient solutions to computational problems by breaking into subproblems and identifying parts that can be abstracted and modularized.

Meaning

UNDERSTANDINGS: Students will understand that…

- U1 – Computers are systems of inputs, outputs, and processors that can perform many tasks very quickly.
- U2 – Computing is a collaborative activity that fosters creativity, communication, and teamwork.
- U3 – People use technology to create useful tools that make our lives easier.
- U4 – Data can be collected and organized to represent meaningful information using digital tools.
- U5 – The Internet is a resource for research and collaboration that must be used in a safe and responsible way.
- U6 – The display on a digital screen corresponds to an x-y coordinate system.
- U7 – Modularization, breaking problems into subproblems, and abstraction, ignoring details while focusing on common properties, are important steps to take when developing solutions with technology.
- U8 – Computer programs do not need to be right the first time. Testing and fixing things is normal when programming.

ESSENTIAL QUESTIONS: Students will keep considering…

- Q1 – How does a computer system work?
- Q2 – How do humans translate a problem so that a computer can operate on it?
- Q3 – What are the advantages that technology offers to humans that allow us to accomplish things we couldn't do without technology?

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perspectives and considering user preferences. • 1B-AP-15 Test and debug (identify and fix) a program or algorithm to ensure it runs as intended. • 1B-AP-16 Take on varying roles, with teacher guidance, when collaborating with peers during the design, implementation, and review stages of program development. • 1B-IC-19 Brainstorm ways to improve the accessibility and usability of technology products for the diverse needs and wants of users. *Next Generation Science Standards* • 3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost. • 3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem. • 3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved. • ETS1.A Defining and Delimiting Engineering Problems—Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into accounts. • ETS1.B Developing Possible Solutions—Research on a problem should be carried out before beginning to design a solution. At whatever stage, communicating with peers about proposed solutions is an important part of the	**Acquisition** *KNOWLEDGE: Students will…* • K1 – Explain why computer scientists break big problem into subproblems. U7 • K2 – Identify parts of a computational solution that can be abstracted and modularized in order to make the solution efficient and generalizable. U7 • K3 – Identify basic input and output devices in computer systems. U1 • K4 – Give examples of real-life applications of computer systems. U2, U3, U4, U5 • K5 – Give examples of how collaboration can lead to better solution design. U2, U3, U8 • K6 – Recognize that a data set can be represented in various ways to convey different information. U4 • K7 – Explain safe and responsible use of the Internet. U5 • K8 – Identify events that drive a program's behavior such as external user interaction and internal variable counters. U1, U3, U4, U6	*SKILLS: Students will…* • S1 – Organize and collaborate with group members by assigning roles and taking turns. U2 • S2 – Use technology to express ideas. U1, U2, U3, U4, U5, U6, U7, U8 • S3 – Decompose a problem and use a predefined set of commands to write an algorithm that will solve the problem. U1, U7 • S4 – Demonstrate the correct use of the x-y coordinate system when manipulating object positions and movement on a screen during an animated solution. U6, U7 • S5 – Use functions to modularize repetitive tasks, break a program down into smaller pieces, and to make the program more efficient. U7 • S6 – Use variables appropriately as part of a computational solution to store and manipulate values that may change as the program runs. U7 • S7 – Implement a loop when appropriate to make a program repeat a section of code until an ending condition is reached. U7 • S8 – Use a conditional statement in a program as a true/false test to make the program follow a specified sequence of steps depending on the state of the condition. U7 • S9 – Program characters in an animation or game to respond to event triggers. U1, U2, U3, U6, U7, U8 • S10 – Demonstrate persistence in the cycle of testing, finding, and fixing problems in

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design process, and shared ideas can lead to improved designs. *Common Core ELA* • CCSS.ELA-LITERACY.L.3.1 Demonstrate command of the conventions of standard English grammar and usage when writing or speaking. • CCSS.ELA-Literacy.3.RI.3 Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect. • CCSS.ELA-Literacy.3.SL.1 Follow agreed-upon rules for discussions (e.g., gaining the floor in respectful ways, listening to others with care, speaking one at a time about the topics and texts under discussion). *Common Core Math* • CCSS.Math.Practice.MP1 Make sense of problems and persevere in solving them. • CCSS.Math.Practice.MP2 Reason abstractly and quantitatively. • CCSS.Math.Practice.MP4 Model with Mathematics. • CCSS.Math.Practice.MP5 Use appropriate tools strategically.		computer programs. U2, U7, U8 • S11 – Identify similarities between a computer system and a human body (input, processing, output). U1 • S12 – Explain how text and image data can be represented by strings of 1s and 0s. U1, U4

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Evidence *(stage 2)*			Learning Plan *(stage 3)*	
Activities (A) Projects (P) Problems (B) (Module level)	Assessments FOR Learning	Assessments OF Learning	Activities (A), Projects (P), and Problems(B)	Knowledge and Skills
Activity 1 Input, Processing, and Output	Teacher will observe students as they participate in the role-playing activity. Teacher will answer questions during the activity.	Launch Logs will display students' understanding of the parallels between human body systems and computer systems. Students will demonstrate knowledge of inputs, processors, supporting structures, and outputs in both systems. Conclusion questions can be discussed to help assess student understanding.	4_3_1A Input, Processing, and Output • In this activity students learn about the anatomy of a computer system and its similarities to a human body, including input, processing, and output. Students learn the roles of basic computer hardware components and how they compare to the functions of human organs. • Students watch a video presentation that corresponds to the Biomedical Science Launch module 4_4. Students map the similar functions of parts of the human body to those of the computer: eyes/ears, sense/nerves (input), brain (processor), nerves/muscles (output), mouth (output). • Input, Output, Reaction Time. Students play a game where they measure reaction time as a group by passing a signal around a circle—first from hand to shoulder and then from hand to ankle. This will allow them to see the difference in reaction time when the pathway from shoulder to brain to hand is shorter than the pathway from ankle to brain to hand.	K3, S1, S11
Activity 2 Information Highway	Teacher will discuss content with students and answer their questions. Teacher will check student worksheets. Teacher will observe students' participation in group activity.	Launch Logs will show students' knowledge of data translation into bits and will demonstrate that they can transfer this to similar situations. Conclusion questions can be discussed to help assess student understanding.	4_3_2A Information Highway • In this activity students are introduced to the concept of abstraction and data representation in a computer system. Students learn that all electronic information must be translated to bits of data to be understood by the computer. • Basic information about the Internet is addressed, including privacy, safety, and appropriate behavior.	K1, K4, K7, S12
Activity 3 Data Collection and Display	Teacher will discuss with students, answer questions, and observe	Teacher will evaluate the end product (Collect-Count-Display program) from each	4_3_3A Data Collection and Display • In this activity students begin by looking at data sets and considering how the data can be represented in different	K1, K6, K8, S4, S5, S6, S7, S8, S10

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	students' participation in group programming.	team of students. Launch Log entries will demonstrate students' understanding of the system they built. Conclusion questions can be discussed to help assess student understanding.	ways. • Students are introduced to programming using Tynker. Students learn basic programming concepts, including sequencing, repetitions, conditionals, events, functions, and using variables. • Students program an interactive game that collects data and then displays the collected data in a visual representation. • Students learn to break a problem down into subproblems and understand what data needs to be stored so it can be operated on later.	
Project 4 Reaction Test	Teacher will discuss with students, answer questions, and observe students' participation in group programming.	Teacher will evaluate the end product (Reaction Test program) from each team of students. Launch Log entries will demonstrate students' understanding of the system they built. Conclusion questions can be discussed to help assess student understanding.	4_3_4P Reaction Test • In this project students will create an interactive app to test the user's alertness, which can help diagnose a concussion. The app specifications are explicitly defined to the students. • Students will use knowledge and skills learned in the previous activities to process events, use variables, functions, repetitions, and conditionals. • Students will walk through the five steps of the design process as they work through their project. • Students will work in groups and collaborate as they brainstorm ideas and plan their designs in their Launch Logs. • The app that the students create in this project can be used to relate to the Biomedical Science Launch module 4_4.	K2, K4, K5, S1, S2, S3, S9, S10
Problem 5 Brain Fitness	Teacher will discuss with students, answer questions, and observe students' participation in group programming.	Student groups will present their end product (Brain Fitness program). Launch Log entries will demonstrate students' understanding of the system	4_3_5B Brain Fitness • In this problem students will create an interactive app to assess the user's brain function, which can serve as a baseline for concussion testing. There are suggested ideas for the app. However, students choose whether they will use any of the suggestions or create their own idea for the game.	K1 , K2, K3, K4, K5, K8, S1, S2, S3, S4, S5, S6, S7, S8, S9, S10, S11

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		they built. Conclusion questions can be discussed to help assess student understanding.	• Students will use knowledge and skills learned in the previous activities to process events, use variables, functions, repetitions, and conditionals. • Students will walk through the five steps of the design process as they work through their problem. • Students will work in groups and collaborate as they brainstorm ideas and plan their designs in their Launch Logs. • The app that the students create in this project can be used to relate to the Biomedical Science Launch module 4_4.	
I/O: Computer Systems Check for Understanding	Teacher reviews the CFU with the students after they have answered the questions.	Check for Understanding Summative Assessment: –Data representation –Computer input, processing, output –Modularization: functions, variables –Control Flow: repetitions, conditionals, events	I/O: Computer Systems Check for Understanding	K3, K6, K8, S5, S6, S7, S8, S9, S12

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