



Spokane Public Schools Computer Science Principles

Course: Computer Science Principles		Total Framework Hours up to: 180 hours
CIP Code: 110201	<input type="checkbox"/> Exploratory <input checked="" type="checkbox"/> Preparatory	Date Last Modified: 4/10/2015
Career Cluster: Information Technology		Cluster Pathway: Programming and Software Development

COMPONENTS AND ASSESSMENTS

Performance Assessments:

Students will work with a partner to devise and build their own bit--sending “machines.”
 Students will adapt their machines to handle multi--bit messages, and increasingly complex information
 Students will invent a file type/protocol for encoding a complex type of information that has some personal significance

Leadership Alignment:

Creativity and Innovation will be demonstrated when students will work with a partner to design and build their own “Bit Sending Machine” and adapt their machines as complexity increases to handle multi-bit messages and increasingly complex information.

Students will demonstrate **Initiative and Self-Direction** when they work alone to write an individual program, and answer questions about the individual program and about the collaboration with their partner

Students will demonstrate **Information Literacy** when they **Access and Evaluate Information** and **Use and Manage Information** to explore technical challenges and questions that arise from the need to represent digital information in computers and transfer it between people and computational devices.

Standards and Competencies

Standard/Unit: Digital Information

Competencies

Total Learning Hours for Unit: 35 hours

Creativity

- 1.1.1 Apply a creative development process when creating computational artifacts.
- 1.2.1 Create a computational artifact for creative expression. [P2]
- 1.2.2 Create a computational artifact using computing tools and techniques to solve a problem. [P2]
- 1.2.3 Create a new computational artifact by combining or modifying existing artifacts. [P2]
- 1.2.4 Collaborate in the creation of computational artifacts. [P6]
- 1.2.5 Analyze the correctness, usability, functionality, and suitability of computational artifacts. [P4]
- 1.3.1 Use computing tools and techniques for creative expression. [P2]

Abstraction

- 2.1.1 Describe the variety of abstractions used to represent data. [P3]
- 2.1.2 Explain how binary sequences are used to represent digital data. [P5]
- 2.2.1 Develop an abstraction when writing a program or creating other computational artifacts. [P2]

Data

3.1.1 Use computers to process information, find patterns, and test hypotheses about digitally processed information to gain insight and knowledge. [P4]

Global Impacts

7.1.1 Explain how computing innovations affect communication, interaction, and cognition.

[P4]

7.2.1 Explain how computing has impacted innovations in other fields. [P1]

7.4.1 Explain the connections between computing and economic, social, and cultural contexts. [P1]

Aligned Washington State Standards

Information Technology-Programming (CCTC)	ITC10.01 ITC10.01.02 ITC10.01.04 ITC10.02 ITC10.02.01 ITC10.02.02 ITC10.02.03	Demonstrate knowledge of the hardware components associated with information systems. Explain the role of number systems in information systems. Describe elements and types of information processing. Compare classes of software associated with the development and maintenance information systems to develop software and maintain computer systems. Explain the key functions and applications of software. Describe the range of languages used in software development. Summarize how data is organized in software development.
Arts		
Educational Technology	1.1: 1.2: 1.3: 2.1: 2.4:	Innovate: Demonstrate creative thinking, construct knowledge and develop innovative products and processes using technology. Collaborate: Use digital media and environments to communicate and work collaboratively to support individual learning and contribute to the learning of others. Investigate and Think Critically: Research, manage and evaluate information and solve problems using digital tools and resources. Practice Safety: Practice safe, legal and ethical behavior in the use of information and technology. Adapt to Change (Technology Fluency): Transfer current knowledge to new and emerging technologies.
Health and Fitness		
Language		
Math	MP.1 MP.2 MP.4 MP.5 MP.6 MP.7 HSN-Q.A.1 N-Q N-Q.1 N-Q.2 N-Q.3 A-CED A-CED.2 A-CED.3	Make sense of problems and persevere in solving them Reason abstractly and quantitatively Model with mathematics Use appropriate tools strategically Attend to precision Look for and make use of structure Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. Reason quantitatively and use units to solve problems. Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. Define appropriate quantities for the purpose of descriptive modeling. Choose a level of accuracy appropriate to limitations on measurement when reporting quantities Create equations that describe numbers or relationships Create equations in two or more variables to represent relationships between quantities Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.

Reading	<p>RST 11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.</p> <p>RST 11-12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.</p> <p>RST 11-12.9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible</p>
Science	<p>HS-ETS1-1. Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.</p> <p>HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.</p> <p>HS-ETS1-3. Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.</p>
Social Studies	
Speaking and Listening	<p>SL 11-12.1 a-d. Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher led) with diverse partners on grade 8 topics, texts, and issues, building on others' ideas and expressing their own clearly.</p> <p>a. Come to discussions prepared, having read or researched material under study; explicitly draw on that preparation by referring to evidence on the topic, text, or issue to probe and reflect on ideas under discussion.</p> <p>b. Follow rules for collegial discussions and decision-making, track progress toward specific goals and deadlines, and define individual roles as needed.</p> <p>c. Pose questions that connect the ideas of several speakers and respond to others' questions and comments with relevant evidence, observations, and ideas.</p> <p>d. Acknowledge new information expressed by others, and, when warranted, qualify or justify their own views in light of the evidence presented.</p> <p>SL 11-12.4 Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.</p> <p>SL 11-12.5 Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.</p>
Writing	<p>WHST11-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.</p> <p>a. Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.</p> <p>b. Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.</p> <p>c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.</p> <p>d. Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.</p> <p>e. Provide a concluding statement or section that follows from and supports the information or explanation provided (e.g., articulating implications or the significance of the topic).</p> <p>WHST11-12.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.</p> <p>WHST11-12.6 Use technology, including the Internet, to produce, publish, and update individual or shared writing products in</p>

	<p>response to ongoing feedback, including new arguments or information</p> <p>WHST11-12.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.</p> <p>WHST11-12.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.</p> <p>WHST11-12.9 Draw evidence from informational texts to support analysis, reflection, and research.</p> <p>WHST11-12.10 Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.</p>
--	--

COMPONENTS AND ASSESSMENTS

Performance Assessments:

Student work together to invent solutions and protocols to many of the problems that arise
 Students will consider how information might be encrypted to ensure privacy and some of the tradeoffs involved.
 Students will work on problems in encryption that are used as a way to talk about computationally hard problems.

Leadership Alignment:

Work Creatively with Others: Students will work together to invent solutions and protocols to problems that arise in networked communications. Topics will include: Internet Protocol, DNS, TCP/IP, cryptography and other security and hacking concerns.

Standards and Competencies

Standard/Unit: The Internet

Competencies

Total Learning Hours for Unit: 35 hours

Creativity

- 1.2.1 Create a computational artifact for creative expression. [P2]
- 1.2.2 Create a computational artifact using computing tools and techniques to solve a problem. [P2]
- 1.2.4 Collaborate in the creation of computational artifacts. [P6]
- 1.2.5 Analyze the correctness, usability, functionality, and suitability of computational artifacts. [P4]
- 1.3.1 Use computing tools and techniques for creative expression. [P2]

Abstraction

- 2.1.1 Describe the variety of abstractions used to represent data. [P3]
- 2.1.2 Explain how binary sequences are used to represent digital data. [P5]
- 2.3.1 Use models and simulations to represent phenomena. [P3]

Data

- 3.1.1 Use computers to process information, find patterns, and test hypotheses about digitally processed information to gain insight and knowledge. [P4]
- 3.1.2 Collaborate when processing information to gain insight and knowledge. [P6]
- 3.3.1 Analyze how data representation, storage, security, and transmission of data involve computational manipulation of information. [P4]

Algorithms

- 4.1.2 Express an algorithm in a language. [P5]
- 4.2.1 Explain the difference between algorithms that run in a reasonable time and those that do not run in a reasonable time. [P1]
- 4.2.2 Explain the difference between solvable and unsolvable problems in computer science. [P1]
- 4.2.3 Explain the existence of undecidable problems in computer science. [P1]

4.2.4 Evaluate algorithms analytically and empirically for efficiency, correctness, and clarity. [P4]

Programming

5.2.1 Explain how programs implement algorithms. [P3]

5.4.1 Evaluate the correctness of a program. [P4]

6.1.1 Explain the abstractions in the Internet and how the Internet functions. [P3]

Internet

6.2.1 Explain characteristics of the Internet and the systems built on it. [P5]

6.2.2 Explain how the characteristics of the Internet influence the systems built on it. [P4]

6.3.1 Identify existing cybersecurity concerns and potential options to address these issues with the Internet and the systems built on it. [P1]

Global Impacts

7.1.1 Explain how computing innovations affect communication, interaction, and cognition. [P4]

7.2.1 Explain how computing has impacted innovations in other fields. [P1]

7.3.1 Analyze the beneficial and harmful effects of computing. [P4]

7.4.1 Explain the connections between computing and economic, social, and cultural contexts. [P1]

Aligned Washington State Standards

<p>Information Technology-Programming (CCTC)</p>	<p>ITC10.05 Demonstrate technical knowledge of the Internet to develop and maintain IT systems. ITC10.05.01 Describe Internet protocols Describe Internet protocols. ITC10.05.02 Explain Domain Name Server (DNS). ITC10.05.03 Summarize Internet security issues and systems available for addressing them. ITC10.08 Demonstrate knowledge of Web page basics to build an understanding of Web page design and functioning. ITC10.08.01 Explain the features and functions of Web browsing software. ITC10.08.02 Explain the features and functions of Web page design software. ITC10.08.03 Compare and contrast clients and servers. ITC10.08.04 Describe how bandwidth affects data transmission and on-screen image. ITC10.11 Recognize and analyze potential IT security threats to develop and maintain security requirements. ITC10.11.01 Describe potential security threats to information systems. ITC10.11.02 Identify the range of security needs and the problems that can occur due to security lapses. ITC10.11.03 Assess security threats Assess security threats. ITC10.11.04 Develop plans to address security threats. ITC10.11.05 Implement plans to address security procedures. ITC10.11.06 Document security procedures.</p>
<p>Arts</p>	<p>1.1.6 Creates, analyzes, and evaluates the element color when producing a work of art. 1.2.1 Analyzes, applies, and evaluates the skills and techniques of visual arts to create original works of art in two and/or three dimensions. <ul style="list-style-type: none"> • Justifies his/her use of the skills and techniques of visual arts to create artworks around a theme that he/she defines. • Extends the skills, techniques, and processes of visual arts. • Uses perceptual skills (to create imagery from observation), imagination, and forming skills to achieve specific purposes in drawing and painting. • Selects and uses a variety of media and techniques in two and three dimensions to achieve specific purposes. • Uses a variety of photographic and digital media techniques to develop compositions for the purposes of expression. 2.1.1 Applies a creative process to visual arts. <ul style="list-style-type: none"> • Demonstrates a creative process: • Identifies the audience and purpose of the creation of a body of original visual artworks. • Explores, gathers, and interprets information from diverse sources to create original visual artworks. 3.1.1 Analyzes and evaluates the ways that visual arts are used to express feelings and present ideas and applies his/her</p>

	<ul style="list-style-type: none"> understanding when creating artworks. Works independently (with the teacher serving as mentor) to express, synthesize, and present original ideas and feelings by using visual arts symbols in a variety of genres, styles and media. Expresses and/or represents in works of art/design what is perceived and experienced through the senses (seen, felt, smelled, tasted, and/or heard). Articulates and justifies choices of artistic/design in a variety of media and/or styles. <p>3.2.1 Analyzes and evaluates visual artworks that communicate for a specific purpose and applies his/her understanding when creating artworks.</p> <ul style="list-style-type: none"> Analyzes and interprets social perceptions and audience preferences in the production of artworks created for a specific purpose. Works alone and/or in collaboration with others (and with or without the mentoring of a teacher) to plan and create artworks in a variety of media to communicate for a specific purpose. Plans (independently or with the teacher serving as mentor) for the deliberate use of media, materials, and resources to communicate for a specific purpose. Articulates and justifies the rationale used to make artistic choices when communicating for a specific purpose or to a specific audience. Presents fluency of ideas for visual communications for a specific purpose. <p>4.2.1 Analyzes, evaluates, and creates a presentation that integrates visual arts with other content areas.</p> <ul style="list-style-type: none"> Analyzes artworks to identify the connections between the arts and other content areas. Produces an arts presentation and justifies the choices he/she made to integrate the arts with another content area.
	<p>1.1: Innovate: Demonstrate creative thinking, construct knowledge and develop innovative products and processes using technology.</p> <p>1.2: Collaborate: Use digital media and environments to communicate and work collaboratively to support individual learning and contribute to the learning of others.</p> <p>1.3: Investigate and Think Critically: Research, manage and evaluate information and solve problems using digital tools and resources.</p> <p>2.1: Practice Safety: Practice safe, legal and ethical behavior in the use of information and technology.</p> <p>2.2: Operate Systems: Understand technology systems and use hardware and networks to support learning.</p> <p>2.3: Select and Use Applications: Use productivity tools and common applications effectively and constructively.</p>
Health and Fitness	
Language	
Math	<p>MP.1 Make sense of problems and persevere in solving them</p> <p>MP.2 Reason abstractly and quantitatively</p> <p>MP.4 Model with mathematics</p> <p>MP.5 Use appropriate tools strategically</p> <p>MP.6 Attend to precision</p> <p>S-MD Calculate expected values and use them to solve problems</p> <p>S-MD.4 Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value</p> <p>S-MD.5 Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values</p> <p>S-MD.6 Use probabilities to make fair decisions</p> <p>S-MD.7 Analyze decisions and strategies using probability concepts</p>

	<p>HSN-Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.</p> <p>S-CP Understand independence and conditional probability and use them to interpret data</p> <p>S-CP.1 Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events (“or,” “and,” “not”).</p> <p>S-CP.2 Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent.</p>
Reading	<p>RST 11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.</p> <p>RST 11-12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.</p> <p>RST 11-12.9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible</p>
Science	<p>HS-ETS1-1. Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.</p> <p>HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.</p> <p>HS-ETS1-3. Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.</p>
Social Studies	
Speaking and Listening	<p>SL 11-12.1 a-d. Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacherled) with diverse partners on grade 8 topics, texts, and issues, building on others’ ideas and expressing their own clearly.</p> <p>a. Come to discussions prepared, having read or researched material under study; explicitly draw on that preparation by referring to evidence on the topic, text, or issue to probe and reflect on ideas under discussion.</p> <p>b. Follow rules for collegial discussions and decision-making, track progress toward specific goals and deadlines, and define individual roles as needed.</p> <p>c. Pose questions that connect the ideas of several speakers and respond to others’ questions and comments with relevant evidence, observations, and ideas.</p> <p>d. Acknowledge new information expressed by others, and, when warranted, qualify or justify their own views in light of the evidence presented.</p> <p>SL 11-12.2 Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data.</p> <p>SL 11-12.3 Evaluate a speaker’s point of view, reasoning, and use of evidence and rhetoric, assessing the stance, premises, links among ideas, word choice, points of emphasis, and tone used.</p> <p>SL 11-12.4 Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.</p> <p>SL 11-12.5 Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.</p>
Writing	<p>WHST11-12.6 Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information</p> <p>WHST11-12.10 Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.</p>

COMPONENTS AND ASSESSMENTS

Performance Assessments:

Students will solve problems with classic turtle-style programming
Students will blend in elements more commonly seen in apps, like button and text inputs, images
Students will create a small app

Leadership Alignment:

Social and Cross-Cultural Skill is demonstrated when students interact and work effectively with others to participate in program development and leverage individual differences to advance creative methods for designing, developing, testing, and debugging programs, program elements, and small apps.

Critical Thinking and Problem Solving is demonstrated when students will work in teams to design a font and design small apps to solve problems that will be shared beyond the classroom

Standards and Competencies

Standard/Unit: Programming

Competencies

Total Learning Hours for Unit: 45 hours

Creativity

- 1.1.1 Apply a creative development process when creating computational artifacts. [P2]
- 1.2.1 Create a computational artifact for creative expression. [P2]
- 1.2.2 Create a computational artifact using computing tools and techniques to solve a problem. [P2]
- 1.2.4 Collaborate in the creation of computational artifacts. [P6]
- 1.2.5 Analyze the correctness, usability, functionality, and suitability of computational artifacts. [P4]
- 1.3.1 Use computing tools and techniques for creative expression. [P2]

Abstraction

- 2.2.1 Develop an abstraction when writing a program or creating other computational artifacts. [P2]
- 2.2.2 Use multiple levels of abstraction to write programs. [P3]
- 2.2.3 Identify multiple levels of abstractions that are used when writing programs. [P3]

Data

- 3.1.1 Use computers to process information, find patterns, and test hypotheses about digitally processed information to gain insight and knowledge. [P4]
- 3.1.3 Explain the insight and knowledge gained from digitally processed data by using appropriate visualizations, notations, and precise language. [P5]
- 3.2.1 Extract information from data to discover and explain connections, patterns, or trends. [P1]
- 3.3.1 Analyze how data representation, storage, security, and transmission of data involve computational manipulation of information. [P4]

Algorithms

- 4.1.1 Develop an algorithm for implementation in a program. [P2]
- 4.1.2 Express an algorithm in a language. [P5]

Programming

- 5.1.1 Develop a program for creative expression, to satisfy personal curiosity, or to create new knowledge. [P2]
- 5.1.2 Develop a correct program to solve problems. [P2]
- 5.1.3 Collaborate to develop a program. [P6]
- 5.2.1 Explain how programs implement algorithms. [P3]
- 5.3.1 Use abstraction to manage complexity in programs. [P3]
- 5.4.1 Evaluate the correctness of a program. [P4]
- 5.5.1 Employ appropriate mathematical and logical concepts in programming. [P1]

Global Impacts		
7.1.2 Explain how people participate in a problem solving process that scales. [P4]		
7.2.1 Explain how computing has impacted innovations in other fields. [P1]		
7.4.1 Explain the connections between computing and economic, social, and cultural contexts. [P1]		
Aligned Washington State Standards		
Information Technology- Programming (CCTC)	ITPD01.01 ITPD01.02 ITPD01.04 ITPD01.06 ITPD01.08	Identify and analyze customer software needs and requirements to guide programming and software development. Create and use IT-based strategies and project plans when solving specific problems to deliver a product that meets customer specifications. Demonstrate the effective use of tools for software development to develop software applications. Produce (code) a computer application to demonstrate proficiency in developing an application using the appropriate programming language. Perform quality assurance tasks to produce quality products.
Arts		
Educational Technology	1.1: 1.2: 1.3: 2.2: 2.4:	Innovate: Demonstrate creative thinking, construct knowledge and develop innovative products and processes using technology. Collaborate: Use digital media and environments to communicate and work collaboratively to support individual learning and contribute to the learning of others. Investigate and Think Critically: Research, manage and evaluate information and solve problems using digital tools and resources. Operate Systems: Understand technology systems and use hardware and networks to support learning. Adapt to Change (Technology Fluency): Transfer current knowledge to new and emerging technologies.
Health and Fitness		
Language		
Math	MP.1 MP.2 MP.3 MP.4 MP.5 MP.6 MP.7 A-SSE.1a,b A-SSE.2 A-SSE.3.c A-APR.6 A-CED.1 A-CED.2 A-CED.3 A-REI.2 A-REI.3 F-IF.1	Make sense of problems and persevere in solving them Reason abstractly and quantitatively Construct viable arguments and critique the reason of others Model with mathematics Use appropriate tools strategically Attend to precision Look for and make use of structure Interpret expressions that that represent a quantity in terms of its context Use the structure of an expression to identify ways to rewrite it Choose and produce an equivalent form of an expression to reveal and explain the properties of the quantity represented by the expression Rewrite simple rational expressions Create equations in one variable and use them to solve problems Create equations in two or more variables to represent relationships between quantities Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. Solve simple rational and radical equations in one variable and give examples of how extraneous solutions may arise Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then $f(x)$

	<p>F-IF.2 denotes the output of f corresponding to the input x. The graph of f is the graph of the equation $y = f(x)$ Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context</p> <p>F-IF.3 Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers</p> <p>F-IF.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes</p> <p>F-IF.8b Use the properties of exponents to interpret expressions for exponential functions</p> <p>F-BF.1 Write a function that describes a relationship between two quantities</p> <p>F-BF.1a Determine an explicit expression, a recursive process, or steps for calculation from a context</p> <p>F-BF.1b Combine standard function types using arithmetic operations</p> <p>F-LE.1 Distinguish between situations that can be modeled with linear functions and with exponential functions</p> <p>F-LE.1b Recognize situations in which one quantity changes at a constant rate per unit interval relative to another</p> <p>F-LE.1c Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another</p> <p>F-LE.2 Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs</p>
Reading	<p>RST 11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.</p> <p>RST 11-12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.</p> <p>RST 11-12.9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible</p>
Science	<p>HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.</p> <p>HS-ETS1-3. Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.</p> <p>HS-ETS1-4. Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.</p>
Social Studies	
Speaking and Listening	<p>SL 11-12.2 Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data.</p> <p>SL 11-12.4 Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.</p> <p>SL 11-12.5 Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.</p>
Writing	<p>WHST11-12.1 Write arguments focused on discipline-specific content.</p> <p>a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.</p> <p>b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases.</p> <p>c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion,</p>

	and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.
WHST11-12.4	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience
WHST11-12.6	Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.
WHST11-12.7	Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
WHST11-12.10	Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

COMPONENTS AND ASSESSMENTS

Performance Assessments:

Students will design and run monte carlo-type experiments to investigate the answer to data-driven questions that can be simulated on the computer with many trials
 Students will write programs that process large lists of data to perform simple searches or aggregations
 Students will query a remote API that can return data and artifacts

Leadership Alignment:

Critical Thinking and Problem Solving:

Students will Use Systems Thinking when they construct an experiment to investigate the answer to a data-drive question that can be simulated on the computer with multiple trials

Students will Make Judgements and Decisions when they construct an experiment to investigate the answer to a data-drive question that can be simulated on the computer with multiple trials

Students Will Solve Problems when they write programs that process large data sets to perform simple searches or aggregations

Standards and Competencies

Standard/Unit: Data

Competencies

Total Learning Hours for Unit: 35 hours

Creativity

- 1.1.1 Apply a creative development process when creating computational artifacts. [P2]
- 1.2.1 Create a computational artifact for creative expression. [P2]
- 1.2.2 Create a computational artifact using computing tools and techniques to solve a problem. [P2]
- 1.2.4 Collaborate in the creation of computational artifacts. [P6]
- 1.2.5 Analyze the correctness, usability, functionality, and suitability of computational artifacts. [P4]
- 1.3.1 Use computing tools and techniques for creative expression. [P2]

Abstraction

- 2.2.3 Identify multiple levels of abstractions that are used when writing programs. [P3]

- 2.3.1 Use models and simulations to represent phenomena. [P3]
- 2.3.2 Use models and simulations to formulate, refine, and test hypotheses. [P3]
- Data**
- 3.1.1 Use computers to process information, find patterns, and test hypotheses about digitally processed information to gain insight and knowledge. [P4]
- 3.1.2 Collaborate when processing information to gain insight and knowledge. [P6]
- 3.1.3 Explain the insight and knowledge gained from digitally processed data by using appropriate visualizations, notations, and precise language. [P5]
- 3.2.1 Extract information from data to discover and explain connections, patterns, or trends. [P1]
- 3.3.1 Analyze how data representation, storage, security, and transmission of data involve computational manipulation of information. [P4]
- Algorithms**
- 4.1.1 Develop an algorithm for implementation in a program. [P2]
- 4.1.2 Express an algorithm in a language. [P5]
- 4.2.1 Explain the difference between algorithms that run in a reasonable time and those that do not run in a reasonable time. [P1]
- 4.2.4 Evaluate algorithms analytically and empirically for efficiency, correctness, and clarity. [P4]
- Programming**
- 5.1.1 Develop a program for creative expression, to satisfy personal curiosity, or to create new knowledge. [P2]
- 5.1.2 Develop a correct program to solve problems. [P2]
- 5.1.3 Collaborate to develop a program. [P6]
- 5.2.1 Explain how programs implement algorithms. [P3]
- 5.3.1 Use abstraction to manage complexity in programs. [P3]
- 5.4.1 Evaluate the correctness of a program. [P4]
- 5.5.1 Employ appropriate mathematical and logical concepts in programming. [P1]
- Internet**
- 6.3.1 Identify existing cybersecurity concerns and potential options to address these issues with the Internet and the systems built on it. [P1]
- Global Impacts**
- 7.2.1 Explain how computing has impacted innovations in other fields. [P1]
- 7.3.1 Analyze the beneficial and harmful effects of computing. [P4]
- 7.4.1 Explain the connections between computing and economic, social, and cultural contexts. [P1]

Aligned Washington State Standards

Information Technology-Programming (CCTC)	ITPD01.10.01 Explain database development processes. ITPD01.10.02 Create, populate, and maintain a database. Create a database from model specifications using both program code and Graphic User ITPD01.10.03 Perform database interfacing with web applications.
Arts	
Educational Technology	1.1: Innovate: Demonstrate creative thinking, construct knowledge and develop innovative products and processes using technology. 1.2: Collaborate: Use digital media and environments to communicate and work collaboratively to support individual learning and contribute to the learning of others. 1.3: Investigate and Think Critically: Research, manage and evaluate information and solve problems using digital tools and resources. 2.2: Operate Systems: Understand technology systems and use hardware and networks to support learning. 2.3: Select and Use Applications: Use productivity tools and common applications effectively and constructively.

	2.4:	Adapt to Change (Technology Fluency): Transfer current knowledge to new and emerging technologies. (Grades 6-12 only)
Health and Fitness		
Language		
Math	<p>MP.1 Make sense of problems and persevere in solving them</p> <p>MP.2 Reason abstractly and quantitatively</p> <p>MP.3 Construct viable arguments and critique the reason of others</p> <p>MP.4 Model with mathematics</p> <p>MP.5 Use appropriate tools strategically</p> <p>MP.6 Attend to precision</p> <p>MP.7 Look for and make use of structure</p> <p>S-ID 1. Represent data with plots on the real number line (dot plots, histograms, and box plots).</p> <p>S-ID 3. Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).</p> <p>S-IC 1. Understand statistics as a process for making inferences about population parameters based on a random sample from that population.</p> <p>S-IC 2. Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?</p> <p>S-IC 3. Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.</p> <p>S-IC 4. Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.</p> <p>S-IC 6. Evaluate reports based on data.</p> <p>S-CP 1. Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events (“or,” “and,” “not”).</p> <p>S-CP 5. Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.</p> <p>S-CP 6. Find the conditional probability of A given B as the fraction of B’s outcomes that also belong to A, and interpret the answer in terms of the model.</p> <p>S-MD 1. (+) Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space; graph the corresponding probability distribution using the same graphical displays as for data distributions.</p> <p>S-MD 2. (+) Calculate the expected value of a random variable; interpret it as the mean of the probability distribution.</p> <p>S-MD 4. (+) Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value. <i>For example, find a current data distribution on the number of TV sets per household in the United States, and calculate the expected number of sets per household. How many TV sets would you expect to find in 100 randomly selected households?</i></p>	
Reading	<p>RST 11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.</p> <p>RST 11-12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.</p> <p>RST 11-12.9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding</p>	

	of a process, phenomenon, or concept, resolving conflicting information when possible.
Science	<p>HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.</p> <p>HS-ETS1-3. Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.</p> <p>HS-ETS1-4. Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.</p>
Social Studies	
Speaking and Listening	<p>SL 11-12.1 b-d. Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher led) with diverse partners on grade 8 topics, texts, and issues, building on others' ideas and expressing their own clearly.</p> <p>b. Follow rules for collegial discussions and decision-making, track progress toward specific goals and deadlines, and define individual roles as needed.</p> <p>c. Pose questions that connect the ideas of several speakers and respond to others' questions and comments with relevant evidence, observations, and ideas.</p> <p>d. Acknowledge new information expressed by others, and, when warranted, qualify or justify their own views in light of the evidence presented.</p>
Writing	<p>WHST11-12.1 Write arguments focused on discipline-specific content.</p> <p>a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.</p> <p>b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases.</p> <p>c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.</p> <p>WHST11-12.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience</p> <p>WHST11-12.6 Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.</p> <p>WHST11-12.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.</p> <p>WHST 11-12.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience, integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.</p> <p>WHST 11-12.9 Draw evidence from informational texts to support analysis, reflection, and research.</p> <p>WHST 11-12.10 Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.</p>

COMPONENTS AND ASSESSMENTS

Performance Assessments:

Performance Task: Create – Applications from Ideas

- Students partner and work individually and collaboratively to develop programs of choice. Students will be asked to answer questions about the programs and

details about the collaborative process employed.

- Students submit source code (PDF, text, screenshot) and video with voice or text annotation of successful run
- Collaborative reflection on the programs and process describing:
 - Purpose of the collaborative program
 - Identify and explain the use of abstraction
 - Identify and describe the most complicated algorithm employed and what it does
 - Describe the incremental development process employed and problems encountered
- Individual reflection on programs and process:
 - Describe the *purpose* of your individually developed program.
 - The collaborative process used for the collaborative portion
 - Most significant feedback provided to help partner review and revise the collaborative program
 - Most significant feedback partner provided to help review and revise the collaborative program

Performance Task: Explore – Impact of Computing Innovations

- Students select a computing innovation that has significant impact, or the potential for significant impact on our society, economy, or culture, and that possesses the potential for both beneficial and harmful effects to research write responses that convey a deep level of understanding about the innovation and its impact that include the following:

Innovation:

- The innovation name and a description of the intended purpose of the innovation
- Explanation of the technical details of this innovation in terms that someone completely unfamiliar with the innovation would understand
- Description of the role computing plays in implementing the functionality associated with the innovation
- Description of the relationship between data and the innovation

Impact -- Population:

- Description of the population that is impacted by the innovation, including population characteristics such as approximate size, socioeconomic status, geographic location, health, age, gender, ethnicity, race, sexual orientation, and disability

Impact – Social, Cultural, and Economic:

- Description of the long-term and short-term impacts
- Description of the beneficial and harmful effects of the innovation

- Visual Artifact:

- Use a computer to create a visual artifact that illustrates the beneficial or harmful effects of the innovation described -- a graphic, movie, etc. that provides additional insight to explain, clarify, or depict the beneficial or harmful effect of the selected innovation
- Provide a written summary to describe how the visual artifact you created illustrates the benefit or harm of the innovation

Leadership Alignment:

Students will **Communicate Clearly and Collaborate with Others** when they create applications from ideas For this task students will partner to individually and collaboratively develop programs of their choosing and be asked to answer questions about the programs, provide details about how partners collaborated.

Flexibility and Adaptability will be demonstrated when students individually and collaboratively develop programs of their choosing and answer questions about the

programs, and provide details about how their partners collaborated.

Social and Cross-Cultural Skill is demonstrated when students interact and work effectively with others to participate in program development and leverage individual differences to advance creative methods for designing, developing, testing, and debugging programs.

Students will demonstrate **Media Literacy** analyze the purpose of their own communication (analyze media) to create media messages to create a visual artifact that illustrates the beneficial or harmful effects of the innovation described -- a graphic, movie, etc. that provides additional insight to explain, clarify, or depict the beneficial or harmful effect of the selected innovation

Students will **Create Media Products** when they use a computer to create a visual artifact that illustrates the beneficial or harmful effects of the innovation described -- a graphic, movie, etc. that provides additional insight to explain, clarify, or depict the beneficial or harmful effect of the selected innovation

Students will **Apply Technology Effectively** when they develop visual artifacts that illustrate the beneficial or harmful effects of the innovations: graphic, movie, etc.

Students will demonstrate **Initiative and Self-Direction** when they work alone to write an individual program, and answer questions about the individual program and about the collaboration with their partner

Productivity and Accountability is demonstrated when partners work individually and with partners to produce individual programs that must be different from the programs written collaboratively.

Leadership and Responsibility is demonstrated when work as a team to develop a program together and answer questions about it and answer questions about individual programs and the collaboration between partners.

Standards and Competencies

Standard/Unit: Explore and Create

Competencies

Total Learning Hours for Unit: 30 hours

- 1.1.1 Apply a creative development process when creating computational artifacts. [P2]
- 1.2.1 Create a computational artifact for creative expression. [P2]
- 1.2.2 Create a computational artifact using computing tools and techniques to solve a problem. [P2]
- 1.2.3 Create a new computational artifact by combining or modifying existing artifacts. [P2]
- 1.2.4 Collaborate in the creation of computational artifacts. [P6]
- 1.2.5 Analyze the correctness, usability, functionality, and suitability of computational artifacts. [P4]
- 2.2.1 Develop an abstraction when writing a program or creating other computational artifacts. [P2]
- 2.2.2 Use multiple levels of abstraction to write programs. [P3]
- 3.3.1 Analyze how data representation, storage, security, and transmission of data involve computational manipulation of information. [P4]
- 4.1.1 Develop an algorithm for implementation in a program. [P2]
- 4.1.2 Express an algorithm in a language. [P5]
- 5.1.1 Develop a program for creative expression, to satisfy personal curiosity, or to create new knowledge. [P2]
- 5.1.2 Develop a correct program to solve problems. [P2]
- 5.2.1 Explain how programs implement algorithms. [P3]
- 5.3.1 Use abstraction to manage complexity in programs. [P3]
- 5.4.1 Evaluate the correctness of a program. [P4]
- 5.1.3 Collaborate to develop a program. [P6]
- 5.5.1 Employ appropriate mathematical and logical concepts in programming. [P1]

7.1.1 Explain how computing innovations affect communication, interaction, and cognition. [P4]		
7.3.1 Analyze the beneficial and harmful effects of computing. [P4]		
7.4.1 Explain the connections between computing and economic, social, and cultural contexts. [P1]		
Aligned Washington State Standards		
Informational Technology-Programming (CCTC)	ITPD01.07 ITPD01.07.01 ITPD01.07.02 ITPD01.07.03 ITPD01.07.04 ITPD01.08 ITPD01.08.01 ITPD01.08.02	Implement software testing procedures to ensure quality products. Develop a software test plan. Perform testing and validation. Document test results. Develop software testing audit trails. Perform quality assurance tasks to produce quality products. Summarize software quality assurance (QA) procedures. Perform software quality assurance tasks to produce a quality software product.
Arts		
Educational Technology	1.1: 1.2: 1.3: 2.1: 2.2: 2.3: 2.4:	Innovate: Demonstrate creative thinking, construct knowledge and develop innovative products and processes using technology. Collaborate: Use digital media and environments to communicate and work collaboratively to support individual learning and contribute to the learning of others. Investigate and Think Critically: Research, manage and evaluate information and solve problems using digital tools and resources. Practice Safety: Practice safe, legal and ethical behavior in the use of information and technology. Operate Systems: Understand technology systems and use hardware and networks to support learning. Select and Use Applications: Use productivity tools and common applications effectively and constructively. Adapt to Change (Technology Fluency): Transfer current knowledge to new and emerging technologies. (Grades 6-12 only)
Health and Fitness		
Language	L 11-12 1. L 11-12 2.	Demonstrate command of the conventions of standard English grammar and usage when writing or speaking. a. Apply the understanding that usage is a matter of convention, can change over time, and is sometimes contested. b. Resolve issues of complex or contested usage, consulting references (e.g., Merriam-Webster's Dictionary of English Usage, Garner's Modern American Usage) as needed. Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing. a. Observe hyphenation conventions. b. Spell correctly.
Math	MP.1 MP.2 MP.4 MP.5 MP.6 MP.7 N-VM 1. N-VM 2. HSN-Q.A.1	Make sense of problems and persevere in solving them Reason abstractly and quantitatively Model with mathematics Use appropriate tools strategically Attend to precision Look for and make use of structure Recognize vector quantities as having both magnitude and direction. Represent vector quantities by directed line segments, and use appropriate symbols for vectors and their magnitudes (e.g., v , $ v $, $\ v\ $, v). Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point. Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret

	<p>units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.</p> <p>HSN-Q.A.2 Define appropriate quantities for the purpose of descriptive modeling.</p> <p>HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.</p> <p>S-IC 2. Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?</p> <p>S-IC 3. Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.</p> <p>S-CP 1. Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events (“or,” “and,” “not”).</p> <p>S-MD 7. Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).</p>
Reading	<p>RST 11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.</p> <p>RST 11-12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.</p> <p>RST 11-12.9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.</p>
Science	<p>HS-ETS1-1. Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.</p> <p>HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.</p> <p>HS-ETS1-3. Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.</p> <p>HS-ETS1-4. Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.</p>
Social Studies	
Speaking and Listening	<p>SL 11-12.1 a-d. Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher led) with diverse partners on grade 8 topics, texts, and issues, building on others’ ideas and expressing their own clearly.</p> <p>a. Come to discussions prepared, having read or researched material under study; explicitly draw on that preparation by referring to evidence on the topic, text, or issue to probe and reflect on ideas under discussion.</p> <p>b. Follow rules for collegial discussions and decision-making, track progress toward specific goals and deadlines, and define individual roles as needed.</p> <p>c. Pose questions that connect the ideas of several speakers and respond to others’ questions and comments with relevant evidence, observations, and ideas.</p> <p>d. Acknowledge new information expressed by others, and, when warranted, qualify or justify their own views in light of the evidence presented.</p> <p>SL 11-12.2 Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data.</p> <p>SL 11-12.3 Evaluate a speaker’s point of view, reasoning, and use of evidence and rhetoric, assessing the stance, premises, links among ideas, word choice, points of emphasis, and tone used.</p> <p>SL 11-12.4 Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.</p>

	SL 11-12.5	Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.
Writing	WHST 11-12.1	Write arguments focused on discipline-specific content. a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence. b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases. c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims. d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing. e. Provide a concluding statement or section that follows from or supports the argument presented.
	WHST11-12.2	Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. a. Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension. b. Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic. c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts. d. Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers. e. Provide a concluding statement or section that follows from and supports the information or explanation provided (e.g., articulating implications or the significance of the topic).
	WHST11-12.4	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
	WHST 11-12.5	Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.
	WHST11-12.6	Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information
	WHST11-12.7	Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
	WHST11-12.8	Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.
	WHST11-12.9	Draw evidence from informational texts to support analysis, reflection, and research.
	WHST11-12.10	Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.
	COMPONENTS AND ASSESSMENTS	

21st Century Skills

Check those that students will demonstrate in this course:

LEARNING & INNOVATION

Creativity and Innovation

- Think Creatively
- Work Creatively with Others
- Implement Innovations

Critical Thinking and Problem Solving

- Reason Effectively
- Use Systems Thinking
- Make Judgments and Decisions
- Solve Problems

Communication and Collaboration

- Communicate Clearly
- Collaborate with Others

INFORMATION, MEDIA & TECHNOLOGY SKILLS

Information Literacy

- Access and /evaluate Information
- Use and Manage Information

Media Literacy

- Analyze Media
- Create Media Products

Information, Communications and Technology (ICT Literacy)

- Apply Technology Effectively

LIFE & CAREER SKILLS

Flexibility and Adaptability

- Adapt to Change
- Be Flexible

Initiative and Self-Direction

- Manage Goals and Time
- Work Independently
- Be Self-Directed Learners

Social and Cross-Cultural

- Interact Effectively with Others
- Work Effectively in Diverse Teams

Productivity and Accountability

- Manage Projects
- Produce Results

Leadership and Responsibility

- Guide and Lead Others
- Be Responsible to Others