Auburn School District Frameworks: Robotics Technology

Course: STEM Robotics Engineering		**Total Framework Hours up to: 180**
CIP Code: 150405	☐ **Exploratory** ☒ **Preparatory**	**Date Last Modified: 8/29/2016**
Career Cluster: Manufacturing		**Cluster Pathway: Manufacturing Production Process Development**

Course Resources

This course is designed to help meet current workforce shortages in the area of science, math, and technology. This course has been approved by our local advisory committee and will be reviewed annually to update technology requirements. This course works in conjunction with the **FIRST** (For Inspiration and Recognition of Science and Technology) Robotics organization for competitive events and student leadership activities. Through **FIRST**, students are able to work with mentors from our local business community to prepare for competitions and participate in other local, state, and national events.

Resources and Standards used in Framework Development:

- FIRST Robotics Program
- ETCAI (Electricity and Electronics Teaching Tools)
- ISCET (International Society of Certified Electronics Technicians)
- Electronic Kourseware Interactive (EKI) Curriculum
- Robotics Engineering Curriculum
- NXT Video Trainer
- Robolab Video Trainer
- LEGO Mindstorms EV3 Curriculum and programming Software
- Tetrix Curriculum Materials
- Vex Robotics Curriculum
- National Instruments LabVIEW programming
- Occupational Safety and Health Administration Resources
- OSPI Safety Guide
- OSPI Industrial Robotics
- 21st Century Skills (Leadership)
- Local Advisory Board

Unit 1: Safety and STEM Career Awareness (covered as appropriate throughout course)

COMPONENTS AND ASSESSMENTS

Performance Assessments:
Student will demonstrate knowledge and skills of Robotics lab safety.
Student will present a plan to pursue a self-selected STEM career pathway

Leadership Alignment:
1.1 Analyze, refine and apply decision-making skills
1.3 Demonstrate oral, interpersonal, written and electronic communication and presentation skills
1.4 Be involved in activities that require applying theory, problem-solving and using critical thinking skills while understanding the outcomes of related decisions
1.6 Conduct self in a professional manner in practical career applications, organizational forums, and decision-making goals;
2.A.1 Use various types of reasoning (inductive, deductive, etc.) as appropriate to the situation

Standards and Competencies

Standard/Unit:
Describe health and safety procedures in a NXT Robotics lab.
Identify STEM careers and pathways.

Competencies	**Total Learning Hours for Unit: 10**

- Identify health and safety risks in a NXT Robotics lab
- Explain health and safety procedures which address risks in a NXT Robotics lab
- Identify health and safety risks in a Tetrix Robotics lab
- Explain health and safety procedures which address risks in a Tetrix Robotics lab
- Describe the breadth of possible STEM careers
- Identify and explore a STEM career related to an area of student interest
- Explain the education pathway to a given STEM career

Aligned Common Core & Washington State Standards

Art	4.5.1: Applies and analyzes how arts knowledge, skills, and work habits are needed and used in the world of work.
Communications	9-10SL2: Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source. 11-12SL2: 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. 9-10SL 4:Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task. 11-12SL 4: Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks.
Educational Technology	1.3.2: Locate and organize information from a variety of sources and media. 2.2.1: Develop skills to use technology effectively. 2.2.2: Use a variety of hardware to support learning
Health and Fitness	
Math	N-Q1: 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. N-Q2: Define appropriate quantities for the purpose of descriptive modeling. N-Q3: Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. A-SSE1: Interpret expressions that represent a quantity in terms of its context.

	S-MD 5: (+) Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values.
Reading	9-10RST1: Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. 11-12RST1: Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. 9-10RST7: Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. 11-12RST7: 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. 9-10RST9: Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts. 11-12RST9: 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.
Science	9-12 SYSA: Feedback is a process in which the output of a system provides information used to regulate the operation of the system. Positive feedback increases the disturbance to a system. Negative feedback reduces the disturbance to a system. 9-12 SYSB: Systems thinking can be especially useful in analyzing complex situations. To be useful, a system needs to be specified as clearly as possible. 9-12 SYSC: In complex systems, entirely new and unpredictable properties may emerge. Consequently, modeling a complex system in sufficient detail to make reliable predictions may not be possible. 9-12 APPB: The technological design process begins by defining a problem in terms of criteria and constraints, conducting research, and generating several different solutions. 9-12 APPC: Choosing the best solution involves comparing alternatives with respect to criteria and constraints, then building and testing a model or other representation of the final design. 9-12 APPD: The ability to solve problems is greatly enhanced by use of mathematics and information technologies. 9-12 APPE: Perfect solutions do not exist. All technological solutions involve trade-offs in which decisions to include more of one quality means less of another. All solutions involve consequences, some intended, others not. 9-12 APPF: It is important for all citizens to apply science and technology to critical issues that influence society. 9-11 PS1G: Electrical force is a force of nature independent of gravity that exists between charged objects. Opposite charges attract while like charges repel. 9-11 PS1H: Electricity and magnetism are two aspects of a single electromagnetic force. Moving electric charges produce magnetic forces, and moving magnets produce electric forces. 9-11 PS3A: Although energy can be transferred from one object to another and can be transformed from one form of energy to another form, the total energy in a closed system remains the same. The concept of conservation of energy, applies to all physical and chemical changes.
Social Studies	
Writing	9-12WHST2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. 9-12WHST4: Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. 9-10WHST6: Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically. 11-12WHST6: 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.

Unit 2: Introduction to Robotics

COMPONENTS AND ASSESSMENTS	
Performance Assessments: Student will create a research report on real and fictional robots. Student will demonstrate key attributes of NXT components. Student will assemble NXT golfing machine.	
Leadership Alignment: 1.3 Demonstrate oral, interpersonal, written and electronic communication and presentation skills 2.1 Communicate, participate, and advocate effectively in pairs, small groups, teams and large groups in order to reach common goals 3.A.1 Articulate thoughts and ideas effectively using oral, written and nonverbal communication skills in a variety of forms and contexts	
Standards and Competencies	
Standard/Unit: Describe characteristics of robots and explain/use NXT components	
Competencies	**Total Learning Hours for Unit: 15**
• Identify characteristics of a robot • Create a research report on important/iconic robotics, both real and fictional • Describe how the functions and characteristics of a robot can been seen in the NXT system • Explain the sense and response systems of the NXT system • Document/describe key attributes of the NXT electronic, mechanical and structural components • Explain the function of a two-gear gear train through the bicycle analogy • Construct an NXT Golfing Machine based on Faraday's Principle	
Aligned Common Core & Washington State Standards	
Art	4.5.1: Applies and analyzes how arts knowledge, skills, and work habits are needed and used in the world of work.
Communications	9-10SL1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grades 9–10 topics, texts, and issues,* building on others' ideas and expressing their own clearly and persuasively. 11-12SL1: Initiate and participate effectively in a range of collaborative discussions (one-on- one, in groups, and teacher-led) with diverse partners on *grades 11–12 topics, texts, and issues,* building on others' ideas and expressing their own clearly and persuasively. 9-10SL2: Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source. 11-12SL2: 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. 9-10SL4:Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task. 11-12SL4: Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks.
Educational Technology	1.1.1: Generate ideas and create original works for personal and group expression using a variety of digital tools. 1.2.1: Communicate and collaborate to learn with others. 1.3.2: Locate and organize information from a variety of sources and media.
Health and Fitness	
Math	N-Q1: 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.

	N-Q2: Define appropriate quantities for the purpose of descriptive modeling. N-Q3: Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. A-SSE1: Interpret expressions that represent a quantity in terms of its context. A-CED3: 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	9-10RI4: Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the cumulative impact of specific word choices on meaning and tone. 11-12RI4: Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze how an author uses and refines the meaning of a key term or terms over the course of a text. 9-10RST1: Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. 11-12RST1: Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. 9-10RST3: Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. 11-12RST3: Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. 9-10RST7: Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. 11-12RST7: 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. 9-10RST9: Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts. 11-12RST9: 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.
Science	9-12SYSA: Feedback is a process in which the output of a system provides information used to regulate the operation of the system. Positive feedback increases the disturbance to a system. Negative feedback reduces the disturbance to a system. 9-12SYSB: Systems thinking can be especially useful in analyzing complex situations. To be useful, a system needs to be specified as clearly as possible. 9-12SYSC: In complex systems, entirely new and unpredictable properties may emerge. Consequently, modeling a complex system in sufficient detail to make reliable predictions may not be possible. 9-12APPB: The technological design process begins by defining a problem in terms of criteria and constraints, conducting research, and generating several different solutions. 9-12APPC: Choosing the best solution involves comparing alternatives with respect to criteria and constraints, then building and testing a model or other representation of the final design. 9-12APPD: The ability to solve problems is greatly enhanced by use of mathematics and information technologies. 9-12APPE: Perfect solutions do not exist. All technological solutions involve trade-offs in which decisions to include more of one quality means less of another. All solutions involve consequences, some intended, others not. 9-12APPF: It is important for all citizens to apply science and technology to critical issues that influence society. 9-11PS1C: An object at rest will remain at rest unless acted on by an unbalanced force. An object in motion at constant velocity will continue at the same velocity unless acted on by an unbalanced force. (Newton's First Law of Motion, the Law of Inertia) 9-11PS1G: Electrical force is a force of nature independent of gravity that exists between charged objects. Opposite charges attract while like charges repel. 9-11PS1H: Electricity and magnetism are two aspects of a single electromagnetic force. Moving electric charges produce magnetic forces, and moving magnets produce electric forces. 9-11PS3A: Although energy can be transferred from one object to another and can be transformed from one form of energy to another

	form, the total energy in a closed system remains the same. The concept of conservation of energy, applies to all physical and chemical changes.
Social Studies	4.1.1: Analyzes a major historical event and how it is represented on timelines from different cultural perspectives.
Writing	9-12WHST2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. 9-12WHST4: Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. 9-12WHST5: 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. 9-10WHST6: Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically. 11-12WHST6: 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. 9-12WHST10: 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.

Unit 3: Circuits and Computers

COMPONENTS AND ASSESSMENTS

Performance Assessments:
Student will build NXT circuits and run test programs on the NXT computer

Leadership Alignment:
1.4 Be involved in activities that require applying theory, problem-solving and using critical thinking skills while understanding the outcomes of related decisions
2.1 Communicate, participate, and advocate effectively in pairs, small groups, teams and large groups in order to reach common goals
2.6 Use knowledge, build interest, guide, influence decisions, organize efforts, and involve members of a group to assure that a pre-planned group activity is completed
3.A.1 Use communication for a range of purposes (e.g. to inform, instruct, motivate and persuade)

Standards and Competencies

Standard/Unit:
Build Robotic circuits and run robotics programs

Competencies | **Total Learning Hours for Unit: 10**

- Explain the four parts of a circuit and give examples of each
- Differentiate between insulators, conductors and semiconductors
- Describe how the NXT acts as a circuit
- List examples of insulators, conductors and semiconductors within the NXT system
- Explain the advantage of each of the NXT power source options
- Build five NXT test circuits to demonstrate the capabilities of the various sensors
- Explain the four reasons tube based computers stagnated and how the transistor solved these issues
- Define and explain Moore's Law
- Describe the four parts of a computer
- Distinguish between the different type of storage in a computer
- Describe how the NXT acts a as a computer and the role of its different types of memory chips
- Run five NXT test programs and identify the parts of the NXT computer used by each

Aligned Common Core & Washington State Standards

Art	
Communications	9-10SL1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grades 9–10 topics, texts, and issues,* building on others' ideas and expressing their own clearly and persuasively. 11-12SL1: Initiate and participate effectively in a range of collaborative discussions (one-on- one, in groups, and teacher-led) with diverse partners on *grades 11–12 topics, texts, and issues,* building on others' ideas and expressing their own clearly and persuasively. 9-10SL2: Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source. 11-12SL2: 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.
Educational Technology	1.2.1: Communicate and collaborate to learn with others. 2.2.1: Develop skills to use technology effectively. 2.2.2: Use a variety of hardware to support learning.
Health and Fitness	
Math	N-Q1: 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. N-Q2: Define appropriate quantities for the purpose of descriptive modeling.

	N-Q3: Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. A-SSE1: Interpret expressions that represent a quantity in terms of its context. A-CED1: Create equations and inequalities in one variable and use them to solve problems. A-CED2: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. F-LE1: Distinguish between situations that can be modeled with linear functions and with exponential functions. F-LE3: Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function. F-LE4: For exponential models, express as a logarithm the solution to abct = d where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology. F-LE5: Interpret the parameters in a linear or exponential function in terms of a context.
Reading	9-10RI4: Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the cumulative impact of specific word choices on meaning and tone. 11-12RI4: Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze how an author uses and refines the meaning of a key term or terms over the course of a text. 9-10RST1: Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. 11-12RST1: Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. 9-10RST3: Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. 11-12RST3: Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. 9-10RST7: Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. 11-12RST7: 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.
Science	9-12SYSA: Feedback is a process in which the output of a system provides information used to regulate the operation of the system. Positive feedback increases the disturbance to a system. Negative feedback reduces the disturbance to a system. 9-12SYSB: Systems thinking can be especially useful in analyzing complex situations. To be useful, a system needs to be specified as clearly as possible. 9-12SYSC: In complex systems, entirely new and unpredictable properties may emerge. Consequently, modeling a complex system in sufficient detail to make reliable predictions may not be possible. 9-12APPB: The technological design process begins by defining a problem in terms of criteria and constraints, conducting research, and generating several different solutions. 9-12APPC: Choosing the best solution involves comparing alternatives with respect to criteria and constraints, then building and testing a model or other representation of the final design. 9-12APPD: The ability to solve problems is greatly enhanced by use of mathematics and information technologies. 9-12APPE: Perfect solutions do not exist. All technological solutions involve trade-offs in which decisions to include more of one quality means less of another. All solutions involve consequences, some intended, others not. 9-12APPF: It is important for all citizens to apply science and technology to critical issues that influence society. 9-11PS1G: Electrical force is a force of nature independent of gravity that exists between charged objects. Opposite charges attract while like charges repel. 9-11PS1H: Electricity and magnetism are two aspects of a single electromagnetic force. Moving electric charges produce magnetic forces, and moving magnets produce electric forces. 9-11PS2A: Atoms are composed of protons, neutrons, and electrons. The nucleus of an atom takes up very little of the atom’s volume but

	makes up almost all of the mass. The nucleus contains protons and neutrons, which are much more massive than the electrons surrounding the nucleus. Protons have a positive charge, electrons are negative in charge, and neutrons have no net charge. 9-11PS3A: Although energy can be transferred from one object to another and can be transformed from one form of energy to another form, the total energy in a closed system remains the same. The concept of conservation of energy, applies to all physical and chemical changes.
Social Studies	4.1.1: Analyzes a major historical event and how it is represented on timelines from different cultural perspectives.
Writing	9-10WHST6: Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically. 11-12WHST6: 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. 9-12WHST10: 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.

Unit 4: Hardware, Software, Firmware

COMPONENTS AND ASSESSMENTS	
Performance Assessments: Students will build a robot and write simple programs to control it using firmware	
Leadership Alignment: 1.4 Be involved in activities that require applying theory, problem-solving and using critical thinking skills while understanding the outcomes of related decisions 2.1 Communicate, participate, and advocate effectively in pairs, small groups, teams and large groups in order to reach common goals 2.D.2 Identify and ask significant questions that clarify various points of view and lead to better solutions	
Standards and Competencies	
Standard/Unit: Understand the roles of hardware, software and firmware, and how they interact in the NXT	
Competencies	**Total Learning Hours for Unit: 10**
• Describe the role of each of the three parts of a microprocessor's hardware • Describe the nature and role of software in a microprocessor • Explain how a microprocessor's hardware and software work together • Update the NXT firmware and use it to explore the NXT systems and run test programs • Use the NXT firmware to explore the NXT systems and run test programs • Use the NXT hardware to build a robot from pictorial instructions • Write 5-step on-board programs for the NXT using firmware capability	
Aligned Common Core & Washington State Standards	
Art	
Communications	9-10SL1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grades 9–10 topics, texts, and issues,* building on others' ideas and expressing their own clearly and persuasively. 11-12SL1: Initiate and participate effectively in a range of collaborative discussions (one-on- one, in groups, and teacher-led) with diverse partners on *grades 11–12 topics, texts, and issues,* building on others' ideas and expressing their own clearly and persuasively. 9-10SL2: Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source. 11-12SL2: 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.
Educational Technology	1.2.1: Communicate and collaborate to learn with others. 2.2.1: Develop skills to use technology effectively. 2.2.2: Use a variety of hardware to support learning.
Health and Fitness	
Math	N-Q1: 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. N-Q2: Define appropriate quantities for the purpose of descriptive modeling. N-Q3: Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. A-SSE1: Interpret expressions that represent a quantity in terms of its context. A-CED1: Create equations and inequalities in one variable and use them to solve problems.
Reading	9-10RI4: Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the cumulative impact of specific word choices on meaning and tone. 11-12RI4: Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze how an author uses and refines the meaning of a key term or terms over the course of a text. 9-10RST3: Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical

	tasks, attending to special cases or exceptions defined in the text. 11-12RST3: Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. 9-10RST7: Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. 11-12RST7: 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. 9-10RST9: Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts. 11-12RST9: 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.
Science	9-12SYSA: Feedback is a process in which the output of a system provides information used to regulate the operation of the system. Positive feedback increases the disturbance to a system. Negative feedback reduces the disturbance to a system. 9-12SYSB: Systems thinking can be especially useful in analyzing complex situations. To be useful, a system needs to be specified as clearly as possible. 9-12SYSC: In complex systems, entirely new and unpredictable properties may emerge. Consequently, modeling a complex system in sufficient detail to make reliable predictions may not be possible. 9-12APPB: The technological design process begins by defining a problem in terms of criteria and constraints, conducting research, and generating several different solutions. 9-12APPC: Choosing the best solution involves comparing alternatives with respect to criteria and constraints, then building and testing a model or other representation of the final design. 9-12APPD: The ability to solve problems is greatly enhanced by use of mathematics and information technologies. 9-12APPE: Perfect solutions do not exist. All technological solutions involve trade-offs in which decisions to include more of one quality means less of another. All solutions involve consequences, some intended, others not. 9-12APPF: It is important for all citizens to apply science and technology to critical issues that influence society. 9-11PS1G: Electrical force is a force of nature independent of gravity that exists between charged objects. Opposite charges attract while like charges repel. 9-11PS1H: Electricity and magnetism are two aspects of a single electromagnetic force. Moving electric charges produce magnetic forces, and moving magnets produce electric forces. 9-11PS3A: Although energy can be transferred from one object to another and can be transformed from one form of energy to another form, the total energy in a closed system remains the same. The concept of conservation of energy, applies to all physical and chemical changes.
Social Studies	
Writing	9-12WHST2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. 9-12WHST4: Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

Unit 5: Straight Ahead (programming precision forward and reverse motion)

COMPONENTS AND ASSESSMENTS	
Performance Assessments: Student will manipulate the straight movement of a robot through programming parameters	
Leadership Alignment: 1.1 Analyze, refine and apply decision-making skills 1.4 Be involved in activities that require applying theory, problem-solving and using critical thinking skills while understanding the outcomes of related decisions 2.1 Communicate, participate, and advocate effectively in pairs, small groups, teams and large groups in order to reach common goals 3.B.2 Exercise flexibility and willingness to be helpful in making necessary compromises to accomplish a common goal	
Standards and Competencies	
Standard/Unit: Program a robot for precise forward and reverse motion. Determine and use the relationship between power level and travel time/speed	
Competencies	**Total Learning Hours for Unit: 13**
• Manipulate the Video Trainer software • Download a program from NXT-G to a robot • Calculate program parameters based on the circumference of a circle • Program a robot for precision forward and reverse motion • Measure, plot and interpolate travel time vs power level data • Calculate, plot and interpolate speed vs power level data	
Aligned Common Core & Washington State Standards	
Art	
Communications	9-10SL1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grades 9–10 topics, texts, and issues,* building on others' ideas and expressing their own clearly and persuasively. 11-12SL1: Initiate and participate effectively in a range of collaborative discussions (one-on- one, in groups, and teacher-led) with diverse partners on *grades 11–12 topics, texts, and issues,* building on others' ideas and expressing their own clearly and persuasively. 9-10SL2: Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source. 11-12SL2: 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. 9-10SL5: Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. 11-12SL5: Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.
Educational Technology	1.1.1: Generate ideas and create original works for personal and group expression using a variety of digital tools. 1.1.2: Use models and simulations to explore systems, identify trends, and forecast possibilities. 1.2.1: Communicate and collaborate to learn with others. 2.2.1: Develop skills to use technology effectively. 2.2.2: Use a variety of hardware to support learning.
Health and Fitness	
Math	N-Q1: 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.

	N-Q2: Define appropriate quantities for the purpose of descriptive modeling. N-Q3: Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. A-SSE1: Interpret expressions that represent a quantity in terms of its context. A-CED1: Create equations and inequalities in one variable and use them to solve problems. A-CED3: 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. A-CED4: Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. F-IF6: Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. F-BF1: Write a function that describes a relationship between two quantities. G-CO1: Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc. G-MG1: Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder). S-ID1: Represent data with plots on the real number line (dot plots, histograms, and box plots). S-ID7: Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. S-ID9: Distinguish between correlation and causation. S-IC2: Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation.
Reading	9-10RI4: Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the cumulative impact of specific word choices on meaning and tone. 11-12RI4: Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze how an author uses and refines the meaning of a key term or terms over the course of a text. 9-10RI7: Analyze various accounts of a subject told in different mediums (e.g., a person's life story in both print and multimedia), determining which details are emphasized in each account. 11-12RI7: Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem. 9-10RST1: Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. 11-12RST1: Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. 9-10RST3: Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. 11-12RST3: Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. 9-10RST4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 9–10 texts and topics*. 11-12RST4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 11–12 texts and topics*.
Science	9-12SYSA: Feedback is a process in which the output of a system provides information used to regulate the operation of the system. Positive feedback increases the disturbance to a system. Negative feedback reduces the disturbance to a system. 9-12SYSB: Systems thinking can be especially useful in analyzing complex situations. To be useful, a system needs to be specified as clearly as possible. 9-12SYSC: In complex systems, entirely new and unpredictable properties may emerge. Consequently, modeling a complex system in sufficient detail to make reliable predictions may not be possible. 9-12INQA: Scientists generate and evaluate questions to investigate the natural world. 9-12INQC: Conclusions must be logical, based on evidence, and consistent with prior established knowledge.

	9-12INQE: The essence of scientific investigation involves the development of a theory or conceptual model that can generate testable predictions. 9-12INQF: Science is a human endeavor that involves logical reasoning and creativity and entails the testing, revision, and occasional discarding of theories as new evidence comes to light. 9-12INQG: Public communication among scientists is an essential aspect of research. Scientists evaluate the validity of one another's investigations, check the reliability of results, and explain inconsistencies in findings. 9-12INQH: Scientists carefully evaluate sources of information for reliability before using that information. When referring to the ideas or findings of others, they cite their sources of information. 9-12APPB: The technological design process begins by defining a problem in terms of criteria and constraints, conducting research, and generating several different solutions. 9-12APPC: Choosing the best solution involves comparing alternatives with respect to criteria and constraints, then building and testing a model or other representation of the final design. 9-12APPD: The ability to solve problems is greatly enhanced by use of mathematics and information technologies. 9-12APPE: Perfect solutions do not exist. All technological solutions involve trade-offs in which decisions to include more of one quality means less of another. All solutions involve consequences, some intended, others not. 9-11PS1A: Average velocity is defined as a change in position with respect to time. Velocity includes both speed and direction. 9-11PS1B: Average acceleration is defined as a change in velocity with respect to time. Acceleration indicates a change in speed and/or a change in direction. 9-11PS1C: An object at rest will remain at rest unless acted on by an unbalanced force. An object in motion at constant velocity will continue at the same velocity unless acted on by an unbalanced force. (Newton's First Law of Motion, the Law of Inertia).
Social Studies	
Writing	9-12WHST2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. 9-12WHST4: Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. 9-12WHST5: 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. 9-10WHST6: Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically. 11-12WHST6: 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. 9-12WHST10: 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.

Unit 6: Sights, Sounds and Gears (using light sensors, sound sensors, and gearing)

COMPONENTS AND ASSESSMENTS	
Performance Assessments: Student will program a robot to respond to light and sound sensors. Student will calculate gears ratios and design a robot to trade off speed vs torque	
Leadership Alignment: 1.1 Analyze, refine and apply decision-making skills 1.3 Demonstrate oral, interpersonal, written and electronic communication and presentation skills 1.4 Be involved in activities that require applying theory, problem-solving and using critical thinking skills while understanding the outcomes of related decisions 2.1 Communicate, participate, and advocate effectively in pairs, small groups, teams and large groups in order to reach common goals 2.2 Demonstrate knowledge of conflict resolution and challenge management 2.6 Use knowledge, build interest, guide, influence decisions, organize efforts, and involve members of a group to assure that a pre-planned group activity is completed 8.C.1 Go beyond basic mastery of skills and/or curriculum to explore and expand one's own learning and opportunities to gain expertise	
Standards and Competencies	
Standard/Unit: Build robots to responds to light and sound. Calculate and use gear ratios to optimize robot performance	
Competencies	**Total Learning Hours for Unit: 12**
• Explain each parameter of the light sensor configuration panel • Calculate a light sensor threshold • Program a robot to respond to the light sensor • Explain each parameter of the sound block (audible output) configuration panel • Program a robot to respond to give an audible response • Explain each parameter of the sound sensor configuration panel • Calculate a sound sensor threshold • Program a robot to respond to the sound sensor • Explain the timing sensitivity of the sound sensor • Explain gearing up and down in relation to speed and torque • Calculate gear ratios • Describe the difference between Science and Engineering • Build a robot using the Engineering Process which incorporates precision forward motion, gear ratios, light and sound sensors	
Aligned Common Core & Washington State Standards	
Art	
Communications	9-10SL1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grades 9–10 topics, texts, and issues,* building on others' ideas and expressing their own clearly and persuasively. 11-12SL1: Initiate and participate effectively in a range of collaborative discussions (one-on- one, in groups, and teacher-led) with diverse partners on *grades 11–12 topics, texts, and issues,* building on others' ideas and expressing their own clearly and persuasively. 9-10SL2: Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source. 11-12SL2: 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. 9-10SL4:Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of

	reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task. 11-12SL4: Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks. 9-10SL5: Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. 11-12SL5: Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.
Educational Technology	1.1.1: Generate ideas and create original works for personal and group expression using a variety of digital tools. 1.1.2: Use models and simulations to explore systems, identify trends, and forecast possibilities. 1.2.1: Communicate and collaborate to learn with others. 1.3.2: Locate and organize information from a variety of sources and media. 1.3.3: Analyze, synthesize and ethically use information to develop a solution, make informed decisions and report results 2.2.1: Develop skills to use technology effectively. 2.2.2: Use a variety of hardware to support learning. 2.3.1: Select and use common applications. 2.4.1: Formulate and synthesize new knowledge.
Health and Fitness	
Math	N-Q1: 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. N-Q2: Define appropriate quantities for the purpose of descriptive modeling. N-Q3: Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. A-SSE1: Interpret expressions that represent a quantity in terms of its context. A-CED1: Create equations and inequalities in one variable and use them to solve problems. A-CED3: 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. A-CED3: 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. A-CED4: Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. S-ID9: Distinguish between correlation and causation. S-IC2: Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation.
Reading	9-10RI4: Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the cumulative impact of specific word choices on meaning and tone. 11-12RI4: Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze how an author uses and refines the meaning of a key term or terms over the course of a text. 9-10RI7: Analyze various accounts of a subject told in different mediums (e.g., a person's life story in both print and multimedia), determining which details are emphasized in each account. 11-12RI7: Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem. 9-10RST1: Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. 11-12RST1: Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. 9-10RST3: Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. 11-12RST3: Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing

	technical tasks; analyze the specific results based on explanations in the text. 9-10RST4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 9–10 texts and topics*. 11-12RST4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 11–12 texts and topics*. 9-10RST7: Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. 11-12RST7: 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. 9-10RST9: Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts. 11-12RST9: 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. 9-10RST10: By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently. 11-12RST10: By the end of grade 12, read and comprehend science/technical texts in the grades 11–CCR text complexity band independently and proficiently.
Science	9-12SYSA: Feedback is a process in which the output of a system provides information used to regulate the operation of the system. Positive feedback increases the disturbance to a system. Negative feedback reduces the disturbance to a system. 9-12SYSB: Systems thinking can be especially useful in analyzing complex situations. To be useful, a system needs to be specified as clearly as possible. 9-12SYSC: In complex systems, entirely new and unpredictable properties may emerge. Consequently, modeling a complex system in sufficient detail to make reliable predictions may not be possible. 9-12INQA: Scientists generate and evaluate questions to investigate the natural world. 9-12INQC: Conclusions must be logical, based on evidence, and consistent with prior established knowledge. 9-12INQE: The essence of scientific investigation involves the development of a theory or conceptual model that can generate testable predictions. 9-12INQF: Science is a human endeavor that involves logical reasoning and creativity and entails the testing, revision, and occasional discarding of theories as new evidence comes to light. 9-12INQG: Public communication among scientists is an essential aspect of research. Scientists evaluate the validity of one another's investigations, check the reliability of results, and explain inconsistencies in findings. 9-12INQH: Scientists carefully evaluate sources of information for reliability before using that information. When referring to the ideas or findings of others, they cite their sources of information. 9-12APPB: The technological design process begins by defining a problem in terms of criteria and constraints, conducting research, and generating several different solutions. 9-12APPC: Choosing the best solution involves comparing alternatives with respect to criteria and constraints, then building and testing a model or other representation of the final design. 9-12APPD: The ability to solve problems is greatly enhanced by use of mathematics and information technologies. 9-12APPE: Perfect solutions do not exist. All technological solutions involve trade-offs in which decisions to include more of one quality means less of another. All solutions involve consequences, some intended, others not. 9-12APPF: It is important for all citizens to apply science and technology to critical issues that influence society. 9-11PS1A: Average velocity is defined as a change in position with respect to time. Velocity includes both speed and direction. 9-11PS1B: Average acceleration is defined as a change in velocity with respect to time. Acceleration indicates a change in speed and/or a change in direction. 9-11PS1C: An object at rest will remain at rest unless acted on by an unbalanced force. An object in motion at constant velocity will continue at the same velocity unless acted on by an unbalanced force. (Newton's First Law of Motion, the Law of Inertia)

	9-11 PS1H: Electricity and magnetism are two aspects of a single electromagnetic force. Moving electric charges produce magnetic forces, and moving magnets produce electric forces. 9-11PS3A: Although energy can be transferred from one object to another and can be transformed from one form of energy to another form, the total energy in a closed system remains the same. The concept of conservation of energy, applies to all physical and chemical changes. 9-11PS3D: Waves (including sound, seismic, light, and water waves) transfer energy when they interact with matter. Waves can have different wavelengths, frequencies, and amplitudes, and travel at different speeds. 9-11 PS3E: Electromagnetic waves differ from physical waves because they do not require a medium and they all travel at the same speed in a vacuum. This is the maximum speed that any object or wave can travel. Forms of electromagnetic waves include X-rays, ultraviolet, visible light, infrared, and radio.
Social Studies	
Writing	9-12WHST2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. 9-12WHST4: Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. 9-12WHST5: 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. 9-10WHST6: Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically. 11-12WHST6: 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. 9-12WHST10: 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.

Unit 7: Taking Turns (programming precision turns and manipulators)

COMPONENTS AND ASSESSMENTS
Performance Assessments: Student will design and build a robot to maneuver through turns, control an appendage, and design a program from a flow chart
Leadership Alignment: 1.1 Analyze, refine and apply decision-making skills; 1.4 Be involved in activities that require applying theory, problem-solving and using critical thinking skills while understanding the outcomes of related decisions; 1.6 Conduct self in a professional manner in practical career applications, organizational forums, and decision-making goals; 2.1 Communicate, participate, and advocate effectively in pairs, small groups, teams and large groups in order to reach common goals; 2.6 Use knowledge, build interest, guide, influence decisions, organize efforts, and involve members of a group to assure that a pre-planned group activity is completed 10.A.1 Set and meet goals, even in the face of obstacles and competing pressures
Standards and Competencies
Standard/Unit: Build robots capable of precision maneuvers, including movable appendages. Plan and develop linear programs.

Competencies	**Total Learning Hours for Unit: 10**
• Explain how each parameter of the Move Block can be configured to control a robot's turning response • Write a program for a robot to maneuver with turns • Write a program for a robot to maneuver with various precision turns • Write a program for a robot to combine turning and sensor response • Create a flowchart to represent a multi-step activity • Develop a robot program from a flow chart • Explain each parameter of the Motor Block • Write a program using the Motor Block to control a third motor in a robot • Design, build and program a robot to write block characters on a horizontal dry-erase board	
Aligned Common Core & Washington State Standards	
Art	2.3.1: Applies a responding process to a presentation/exhibit of visual art
Communications	9-10SL1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grades 9–10 topics, texts, and issues,* building on others' ideas and expressing their own clearly and persuasively. 11-12SL1: Initiate and participate effectively in a range of collaborative discussions (one-on- one, in groups, and teacher-led) with diverse partners on *grades 11–12 topics, texts, and issues,* building on others' ideas and expressing their own clearly and persuasively. 9-10SL2: Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source. 11-12SL2: 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. 9-10SL4:Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task. 11-12SL4: Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks. 9-10SL5: Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. 11-12SL5: Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.
Educational Technology	1.1.2: Use models and simulations to explore systems, identify trends, and forecast possibilities. 1.3.2: Locate and organize information from a variety of sources and media. 1.3.4: Use multiple processes and diverse perspectives to explore alternative solutions
Health and Fitness	
Math	N-Q1: 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. N-Q2: Define appropriate quantities for the purpose of descriptive modeling. N-Q3: Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. A-SSE1: Interpret expressions that represent a quantity in terms of its context. A-CED1: Create equations and inequalities in one variable and use them to solve problems. A-CED2: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. A-CED3: 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. A-CED4: Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.

	F-BF1: Write a function that describes a relationship between two quantities. G-CO1: Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc. G-MG1: Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder). G-MG2: Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). G-MG3: Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios). S-ID9: Distinguish between correlation and causation. S-IC2: Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation.
Reading	9-10RI4: Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the cumulative impact of specific word choices on meaning and tone. 11-12RI4: Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze how an author uses and refines the meaning of a key term or terms over the course of a text. 9-10RI7: Analyze various accounts of a subject told in different mediums (e.g., a person's life story in both print and multimedia), determining which details are emphasized in each account. 11-12RI7: Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem. 9-10RST1: Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. 11-12RST1: Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. 9-10RST3: Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. 11-12RST3: Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. 9-10RST4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 9–10 texts and topics*. 11-12RST4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 11–12 texts and topics*. 9-10RST7: Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. 11-12RST7: 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. 9-10RST9: Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts. 11-12RST9: 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. 9-10RST10: By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently. 11-12RST10: By the end of grade 12, read and comprehend science/technical texts in the grades 11–CCR text complexity band independently and proficiently.
Science	9-12SYSA: Feedback is a process in which the output of a system provides information used to regulate the operation of the system. Positive feedback increases the disturbance to a system. Negative feedback reduces the disturbance to a system. 9-12SYSB: Systems thinking can be especially useful in analyzing complex situations. To be useful, a system needs to be specified as clearly as possible.

	9-12SYSC: In complex systems, entirely new and unpredictable properties may emerge. Consequently, modeling a complex system in sufficient detail to make reliable predictions may not be possible. 9-12INQC: Conclusions must be logical, based on evidence, and consistent with prior established knowledge. 9-12INQE: The essence of scientific investigation involves the development of a theory or conceptual model that can generate testable predictions. 9-12INQF: Science is a human endeavor that involves logical reasoning and creativity and entails the testing, revision, and occasional discarding of theories as new evidence comes to light. 9-12APPB: The technological design process begins by defining a problem in terms of criteria and constraints, conducting research, and generating several different solutions. 9-12APPC: Choosing the best solution involves comparing alternatives with respect to criteria and constraints, then building and testing a model or other representation of the final design. 9-12APPD: The ability to solve problems is greatly enhanced by use of mathematics and information technologies. 9-12APPE: Perfect solutions do not exist. All technological solutions involve trade-offs in which decisions to include more of one quality means less of another. All solutions involve consequences, some intended, others not. 9-11PS1A: Average velocity is defined as a change in position with respect to time. Velocity includes both speed and direction. 9-11PS1C: An object at rest will remain at rest unless acted on by an unbalanced force. An object in motion at constant velocity will continue at the same velocity unless acted on by an unbalanced force. (Newton's First Law of Motion, the Law of Inertia) 9-11 PS1H: Electricity and magnetism are two aspects of a single electromagnetic force. Moving electric charges produce magnetic forces, and moving magnets produce electric forces. 9-11PS3A: Although energy can be transferred from one object to another and can be transformed from one form of energy to another form, the total energy in a closed system remains the same. The concept of conservation of energy, applies to all physical and chemical changes.
Social Studies	
Writing	9-12WHST2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. 9-12WHST4: Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. 9-12WHST5: 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. 9-10WHST6: Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically. 11-12WHST6: 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. 9-12WHST10: 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.

Unit 8: See, Touch, Repeat (using ultrasonic sensor, touch sensor and programming with loops)

COMPONENTS AND ASSESSMENTS	
Performance Assessments: Student will design and build a robot to use all four sensors and create programs with repeating behaviors	
Leadership Alignment: 1.1 Analyze, refine and apply decision-making skills; 1.3 Demonstrate oral, interpersonal, written and electronic communication and presentation skills 1.4 Be involved in activities that require applying theory, problem-solving and using critical thinking skills while understanding the outcomes of related decisions; 2.1 Communicate, participate, and advocate effectively in pairs, small groups, teams and large groups in order to reach common goals; 2.6 Use knowledge, build interest, guide, influence decisions, organize efforts, and involve members of a group to assure that a pre-planned group activity is completed 11.B.1 Act responsibly with the interests of the larger community in mind	
Standards and Competencies	
Standard/Unit: Build robots that respond to touch and their proximity to objects. Plan and develop programs with repeating behaviors (loops)	
Competencies	**Total Learning Hours for Unit: 10**
• Describe how computers use digital information to represent numbers, words and images • Explain why computers only use digital information • Explain each parameter of the touch sensor configuration panel • Program a robot to respond to the touch sensor • Explain each parameter of the ultrasonic sensor configuration panel • Program a robot to respond to the ultrasonic sensor • Explain each parameter of the loop configuration panel • Program a robot for repeating behavior controlled by timers, counters and sensors • Design, build and program an animatronic robot which resembles and behaves like a selected animal	
Aligned Common Core & Washington State Standards	
Art	
Communications	9-10SL1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grades 9–10 topics, texts, and issues,* building on others' ideas and expressing their own clearly and persuasively. 11-12SL1: Initiate and participate effectively in a range of collaborative discussions (one-on- one, in groups, and teacher-led) with diverse partners on *grades 11–12 topics, texts, and issues,* building on others' ideas and expressing their own clearly and persuasively. 9-10SL2: Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source. 11-12SL2: 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. 9-10SL4:Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task. 11-12SL4: Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks. 9-10SL5: Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. 11-12SL5: Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.

Educational Technology	1.1.1: Generate ideas and create original works for personal and group expression using a variety of digital tools. 1.1.2: Use models and simulations to explore systems, identify trends, and forecast possibilities. 1.2.1: Communicate and collaborate to learn with others. 1.3.2: Locate and organize information from a variety of sources and media. 1.3.3: Analyze, synthesize and ethically use information to develop a solution, make informed decisions and report results 1.3.4: Use multiple processes and diverse perspectives to explore alternative solutions 2.2.1: Develop skills to use technology effectively. 2.2.2: Use a variety of hardware to support learning. 2.3.1: Select and use common applications. 2.4.1: Formulate and synthesize new knowledge.
Health and Fitness	
Math	N-Q1: 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. N-Q2: Define appropriate quantities for the purpose of descriptive modeling. N-Q3: Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. A-SSE1: Interpret expressions that represent a quantity in terms of its context. A-CED1: Create equations and inequalities in one variable and use them to solve problems. A-CED2: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. A-CED3: 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. A-CED4: Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. F-BF1: Write a function that describes a relationship between two quantities. F-LE1: Distinguish between situations that can be modeled with linear functions and with exponential functions. F-LE2: Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table). F-LE4: For exponential models, express as a logarithm the solution to abct = d where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology. G-MG1: Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder). G-MG2: Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). G-MG3: Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios). S-ID9: Distinguish between correlation and causation. S-IC2: Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation.
Reading	9-10RI4: Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the cumulative impact of specific word choices on meaning and tone. 11-12RI4: Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze how an author uses and refines the meaning of a key term or terms over the course of a text. 9-10RI7: Analyze various accounts of a subject told in different mediums (e.g., a person's life story in both print and multimedia), determining which details are emphasized in each account. 11-12RI7: Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem. 9-10RST1: Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. 11-12RST1: Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author

	makes and to any gaps or inconsistencies in the account. 9-10RST3: Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. 11-12RST3: Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. 9-10RST4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 9–10 texts and topics*. 11-12RST4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 11–12 texts and topics*. 9-10RST7: Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. 11-12RST7: 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. 9-10RST9: Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts. 11-12RST9: 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. 9-10RST10: By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently. 11-12RST10: By the end of grade 12, read and comprehend science/technical texts in the grades 11–CCR text complexity band independently and proficiently.
Science	9-12SYSA: Feedback is a process in which the output of a system provides information used to regulate the operation of the system. Positive feedback increases the disturbance to a system. Negative feedback reduces the disturbance to a system. 9-12SYSB: Systems thinking can be especially useful in analyzing complex situations. To be useful, a system needs to be specified as clearly as possible. 9-12SYSC: In complex systems, entirely new and unpredictable properties may emerge. Consequently, modeling a complex system in sufficient detail to make reliable predictions may not be possible. 9-12INQC: Conclusions must be logical, based on evidence, and consistent with prior established knowledge. 9-12INQE: The essence of scientific investigation involves the development of a theory or conceptual model that can generate testable predictions. 9-12INQF: Science is a human endeavor that involves logical reasoning and creativity and entails the testing, revision, and occasional discarding of theories as new evidence comes to light. 9-12INQG: Public communication among scientists is an essential aspect of research. Scientists evaluate the validity of one another's investigations, check the reliability of results, and explain inconsistencies in findings. 9-12APPB: The technological design process begins by defining a problem in terms of criteria and constraints, conducting research, and generating several different solutions. 9-12APPC: Choosing the best solution involves comparing alternatives with respect to criteria and constraints, then building and testing a model or other representation of the final design. 9-12APPD: The ability to solve problems is greatly enhanced by use of mathematics and information technologies. 9-12APPE: Perfect solutions do not exist. All technological solutions involve trade-offs in which decisions to include more of one quality means less of another. All solutions involve consequences, some intended, others not. 9-12APPF: It is important for all citizens to apply science and technology to critical issues that influence society. 9-11PS1A: Average velocity is defined as a change in position with respect to time. Velocity includes both speed and direction. 9-11PS1C: An object at rest will remain at rest unless acted on by an unbalanced force. An object in motion at constant velocity will continue at the same velocity unless acted on by an unbalanced force. (Newton's First Law of Motion, the Law of Inertia) 9-11 PS1H: Electricity and magnetism are two aspects of a single electromagnetic force. Moving electric charges produce magnetic

	forces, and moving magnets produce electric forces. 9-11PS3A: Although energy can be transferred from one object to another and can be transformed from one form of energy to another form, the total energy in a closed system remains the same. The concept of conservation of energy, applies to all physical and chemical changes. 9-11PS3D: Waves (including sound, seismic, light, and water waves) transfer energy when they interact with matter. Waves can have different wavelengths, frequencies, and amplitudes, and travel at different speeds.
Social Studies	
Writing	9-12WHST2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. 9-12WHST4: Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. 9-12WHST5: 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. 9-10WHST6: Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically. 11-12WHST6: 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. 9-12WHST10: 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.

Unit 9: Decisions (using switch blocks and advanced flow charts)

COMPONENTS AND ASSESSMENTS	
Performance Assessments: Student will design and build a robot that makes decisions based on sensory input	
Leadership Alignment: 1.1 Analyze, refine and apply decision-making skills; 1.4 Be involved in activities that require applying theory, problem-solving and using critical thinking skills while understanding the outcomes of related decisions; 1.6 Conduct self in a professional manner in practical career applications, organizational forums, and decision-making goals; 2.1 Communicate, participate, and advocate effectively in pairs, small groups, teams and large groups in order to reach common goals; 2.6 Use knowledge, build interest, guide, influence decisions, organize efforts, and involve members of a group to assure that a pre-planned group activity is completed 6.A.1 Use technology as a tool to research, organize, evaluate and communicate information	
Standards and Competencies	
Standard/Unit: Build robots that make binary decisions based on sensory input. Plan and develop branching programs with switch blocks nested inside loops.	
Competencies	**Total Learning Hours for Unit: 10**
• Explain each parameter of the switch block configuration panel • Program a robot to make decisions based on sensory input • Explain how a fast switch block nested inside a loop improves detection behavior • Build and program a robot to continuously detect objects • Build and program a robot to follow a line • Create a flow chart to design a hierarchical program • Design, build and program a sumobot robot which pushes an opponent out of an arena	
Aligned Common Core & Washington State Standards	
Art	
Communications	9-10SL1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grades 9–10 topics, texts, and issues,* building on others' ideas and expressing their own clearly and persuasively. 11-12SL1: Initiate and participate effectively in a range of collaborative discussions (one-on- one, in groups, and teacher-led) with diverse partners on *grades 11–12 topics, texts, and issues,* building on others' ideas and expressing their own clearly and persuasively. 9-10SL2: Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source. 11-12SL2: 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. 9-10SL4:Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task. 11-12SL4: Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks. 9-10SL5: Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. 11-12SL5: Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.

Educational Technology	1.1.1: Generate ideas and create original works for personal and group expression using a variety of digital tools. 1.1.2: Use models and simulations to explore systems, identify trends, and forecast possibilities. 1.2.1: Communicate and collaborate to learn with others. 1.3.2: Locate and organize information from a variety of sources and media. 1.3.3: Analyze, synthesize and ethically use information to develop a solution, make informed decisions and report results 1.3.4: Use multiple processes and diverse perspectives to explore alternative solutions 2.2.1: Develop skills to use technology effectively. 2.2.2: Use a variety of hardware to support learning. 2.3.1: Select and use common applications. 2.4.1: Formulate and synthesize new knowledge.
Health and Fitness	
Math	N-Q1: 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. N-Q2: Define appropriate quantities for the purpose of descriptive modeling. N-Q3: Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. A-SSE1: Interpret expressions that represent a quantity in terms of its context. A-CED1: Create equations and inequalities in one variable and use them to solve problems. A-CED2: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. A-CED3: 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. A-CED4: Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. F-BF1: Write a function that describes a relationship between two quantities. F-LE1: Distinguish between situations that can be modeled with linear functions and with exponential functions. F-LE2: Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table). F-LE4: For exponential models, express as a logarithm the solution to abct = d where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology. G-MG1: Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder). G-MG2: Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). G-MG3: Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios). S-ID9: Distinguish between correlation and causation. S-ID9: Distinguish between correlation and causation. S-IC2: Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation.
Reading	9-10RI4: Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the cumulative impact of specific word choices on meaning and tone. 11-12RI4: Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze how an author uses and refines the meaning of a key term or terms over the course of a text. 9-10RI7: Analyze various accounts of a subject told in different mediums (e.g., a person's life story in both print and multimedia), determining which details are emphasized in each account. 11-12RI7: Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem. 9-10RST1: Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. 11-12RST1: Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author

	makes and to any gaps or inconsistencies in the account. 9-10RST3: Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. 11-12RST3: Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. 9-10RST4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 9–10 texts and topics*. 11-12RST4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 11–12 texts and topics*. 9-10RST7: Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. 11-12RST7: 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. 9-10RST9: Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts. 11-12RST9: 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. 9-10RST10: By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently. 11-12RST10: By the end of grade 12, read and comprehend science/technical texts in the grades 11–CCR text complexity band independently and proficiently.
Science	9-12SYSA: Feedback is a process in which the output of a system provides information used to regulate the operation of the system. Positive feedback increases the disturbance to a system. Negative feedback reduces the disturbance to a system. 9-12SYSB: Systems thinking can be especially useful in analyzing complex situations. To be useful, a system needs to be specified as clearly as possible. 9-12SYSC: In complex systems, entirely new and unpredictable properties may emerge. Consequently, modeling a complex system in sufficient detail to make reliable predictions may not be possible. 9-12INQC: Conclusions must be logical, based on evidence, and consistent with prior established knowledge. 9-12INQE: The essence of scientific investigation involves the development of a theory or conceptual model that can generate testable predictions. 9-12INQF: Science is a human endeavor that involves logical reasoning and creativity and entails the testing, revision, and occasional discarding of theories as new evidence comes to light. 9-12INQG: Public communication among scientists is an essential aspect of research. Scientists evaluate the validity of one another's investigations, check the reliability of results, and explain inconsistencies in findings. 9-12APPB: The technological design process begins by defining a problem in terms of criteria and constraints, conducting research, and generating several different solutions. 9-12APPC: Choosing the best solution involves comparing alternatives with respect to criteria and constraints, then building and testing a model or other representation of the final design. 9-12APPD: The ability to solve problems is greatly enhanced by use of mathematics and information technologies. 9-12APPE: Perfect solutions do not exist. All technological solutions involve trade-offs in which decisions to include more of one quality means less of another. All solutions involve consequences, some intended, others not. 9-11PS1A: Average velocity is defined as a change in position with respect to time. Velocity includes both speed and direction. 9-11PS1C: An object at rest will remain at rest unless acted on by an unbalanced force. An object in motion at constant velocity will continue at the same velocity unless acted on by an unbalanced force. (Newton's First Law of Motion, the Law of Inertia) 9-11 PS1H: Electricity and magnetism are two aspects of a single electromagnetic force. Moving electric charges produce magnetic forces, and moving magnets produce electric forces.

	9-11PS3A: Although energy can be transferred from one object to another and can be transformed from one form of energy to another form, the total energy in a closed system remains the same. The concept of conservation of energy, applies to all physical and chemical changes. 9-11PS3D: Waves (including sound, seismic, light, and water waves) transfer energy when they interact with matter. Waves can have different wavelengths, frequencies, and amplitudes, and travel at different speeds. 9-11 PS3E: Electromagnetic waves differ from physical waves because they do not require a medium and they all travel at the same speed in a vacuum. This is the maximum speed that any object or wave can travel. Forms of electromagnetic waves include X-rays, ultraviolet, visible light, infrared, and radio.
Social Studies	
Writing	9-12WHST2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. 9-12WHST4: Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. 9-12WHST5: 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. 9-10WHST6: Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically. 11-12WHST6: 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. 9-12WHST10: 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.

Unit 10: Get a Grip (using gripper arms and my blocks)

COMPONENTS AND ASSESSMENTS	
Performance Assessments: Student will design and build a robot that manipulates objects with a gripper attachment.	
Leadership Alignment: 1.1 Analyze, refine and apply decision-making skills; 1.4 Be involved in activities that require applying theory, problem-solving and using critical thinking skills while understanding the outcomes of related decisions; 1.6 Conduct self in a professional manner in practical career applications, organizational forums, and decision-making goals; 2.1 Communicate, participate, and advocate effectively in pairs, small groups, teams and large groups in order to reach common goals; 2.6 Use knowledge, build interest, guide, influence decisions, organize efforts, and involve members of a group to assure that a pre-planned group activity is completed 1.B.3 Demonstrate originality and inventiveness in work and understand the real world limits to adopting new ideas	
Standard/Unit: Build robots that can grip and manipulate objects. Plan and develop hierarchical programs.	
Competencies	**Total Learning Hours for Unit: 10**
• Describe how computers chip are designed and manufactured • Explain why computers chips are manufactured in "clean rooms" • Build a robot with a gripper attachment • Program a robot to coordinate object manipulation with sensor input • Design a hierarchical program using my blocks • Design, build and program a robot capable of sorting objects by color	
Aligned Common Core & Washington State Standards	
Art	
Communications	9-10SL1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grades 9–10 topics, texts, and issues,* building on others' ideas and expressing their own clearly and persuasively. 11-12SL1: Initiate and participate effectively in a range of collaborative discussions (one-on- one, in groups, and teacher-led) with diverse partners on *grades 11–12 topics, texts, and issues,* building on others' ideas and expressing their own clearly and persuasively. 9-10SL2: Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source. 11-12SL2: 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. 9-10SL4:Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task. 11-12SL4: Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks. 9-10SL5: Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. 11-12SL5: Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.
Educational Technology	1.1.1: Generate ideas and create original works for personal and group expression using a variety of digital tools.

	1.1.2: Use models and simulations to explore systems, identify trends, and forecast possibilities. 1.2.1: Communicate and collaborate to learn with others. 2.2.1: Develop skills to use technology effectively. 2.2.2: Use a variety of hardware to support learning.
Health and Fitness	
Math	N-Q1: 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. N-Q2: Define appropriate quantities for the purpose of descriptive modeling. N-Q3: Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. A-SSE1: Interpret expressions that represent a quantity in terms of its context. A-CED1: Create equations and inequalities in one variable and use them to solve problems. A-CED2: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. A-CED3: 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. A-CED4: Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. F-BF1: Write a function that describes a relationship between two quantities. F-LE1: Distinguish between situations that can be modeled with linear functions and with exponential functions. F-LE2: Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table). G-CO1: Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc G-MG1: Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder). G-MG2: Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). G-MG3: Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios). S-ID9: Distinguish between correlation and causation. S-ID9: Distinguish between correlation and causation. S-IC2: Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation.
Reading	9-10RI4: Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the cumulative impact of specific word choices on meaning and tone. 11-12RI4: Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze how an author uses and refines the meaning of a key term or terms over the course of a text. 9-10RI7: Analyze various accounts of a subject told in different mediums (e.g., a person's life story in both print and multimedia), determining which details are emphasized in each account. 11-12RI7: Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem. 9-10RST1: Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. 11-12RST1: Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. 9-10RST3: Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. 11-12RST3: Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. 9-10RST4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific

	scientific or technical context relevant to *grades 9–10 texts and topics*. 11-12RST4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 11–12 texts and topics*. 9-10RST7: Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. 11-12RST7: 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. 9-10RST9: Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts. 11-12RST9: 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. 9-10RST10: By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently. 11-12RST10: By the end of grade 12, read and comprehend science/technical texts in the grades 11–CCR text complexity band independently and proficiently..
Science	9-12SYSA: Feedback is a process in which the output of a system provides information used to regulate the operation of the system. Positive feedback increases the disturbance to a system. Negative feedback reduces the disturbance to a system. 9-12SYSB: Systems thinking can be especially useful in analyzing complex situations. To be useful, a system needs to be specified as clearly as possible. 9-12INQF: Science is a human endeavor that involves logical reasoning and creativity and entails the testing, revision, and occasional discarding of theories as new evidence comes to light. 9-12APPB: The technological design process begins by defining a problem in terms of criteria and constraints, conducting research, and generating several different solutions. 9-12APPC: Choosing the best solution involves comparing alternatives with respect to criteria and constraints, then building and testing a model or other representation of the final design. 9-12APPD: The ability to solve problems is greatly enhanced by use of mathematics and information technologies. 9-12APPE: Perfect solutions do not exist. All technological solutions involve trade-offs in which decisions to include more of one quality means less of another. All solutions involve consequences, some intended, others not. 9-11PS1A: Average velocity is defined as a change in position with respect to time. Velocity includes both speed and direction. 9-11PS1C: An object at rest will remain at rest unless acted on by an unbalanced force. An object in motion at constant velocity will continue at the same velocity unless acted on by an unbalanced force. (Newton's First Law of Motion, the Law of Inertia) 9-11 PS1H: Electricity and magnetism are two aspects of a single electromagnetic force. Moving electric charges produce magnetic forces, and moving magnets produce electric forces. 9-11PS3A: Although energy can be transferred from one object to another and can be transformed from one form of energy to another form, the total energy in a closed system remains the same. The concept of conservation of energy, applies to all physical and chemical changes. 9-11PS3D: Waves (including sound, seismic, light, and water waves) transfer energy when they interact with matter. Waves can have different wavelengths, frequencies, and amplitudes, and travel at different speeds. 9-11 PS3E: Electromagnetic waves differ from physical waves because they do not require a medium and they all travel at the same speed in a vacuum. This is the maximum speed that any object or wave can travel. Forms of electromagnetic waves include X-rays, ultraviolet, visible light, infrared, and radio.
Social Studies	
Writing	9-12WHST2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or

Unit 11: Working with Data (using data hubs and wires)

COMPONENTS AND ASSESSMENTS	
Performance Assessments: Student will design and build a robot that use parameters passed from one block of their program to another.	
Leadership Alignment: 1.1 Analyze, refine and apply decision-making skills; 1.4 Be involved in activities that require applying theory, problem-solving and using critical thinking skills while understanding the outcomes of related decisions; 2.1 Communicate, participate, and advocate effectively in pairs, small groups, teams and large groups in order to reach common goals; 2.6 Use knowledge, build interest, guide, influence decisions, organize efforts, and involve members of a group to assure that a pre-planned group activity is completed 2.A.1 Use various types of reasoning (inductive, deductive, etc.) as appropriate to the situation	
Standards and Competencies	
Standard/Unit: Build and program robots that override block data with parameters passed from another block. Plan and develop hierarchical programs which pass parameters between the levels of hierarchy.	
Competencies	**Total Learning Hours for Unit: 10**
• Describe the purpose of a Data Hub in NXT-G • Explain the parameters on the Move Block Data Hub • Program a robot to move with a parameter driven from a Data Hub • Explain the different Data Types in NXT-G • Program a robot to display number-type data using Data Hubs and Conversion Blocks • Design a hierarchical program which passes parameters using data wires with advanced my blocks • Design, build and program a robot capable of line following under remote control	
Aligned Common Core & Washington State Standards	
Art	
Communications	9-10SL1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grades 9–10 topics, texts, and issues,* building on others' ideas and expressing their own clearly and persuasively. 11-12SL1: Initiate and participate effectively in a range of collaborative discussions (one-on- one, in groups, and teacher-led) with diverse partners on *grades 11–12 topics, texts, and issues,* building on others' ideas and expressing their own clearly and persuasively. 9-10SL2: Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source. 11-12SL2: 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. 9-10SL4:Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task. 11-12SL4: Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks. 9-10SL5: Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. 11-12SL5: Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.
Educational Technology	1.1.1: Generate ideas and create original works for personal and group expression using a variety of digital tools. 1.1.2: Use models and simulations to explore systems, identify trends, and forecast possibilities.

	1.2.1: Communicate and collaborate to learn with others. 2.2.1: Develop skills to use technology effectively. 2.2.2: Use a variety of hardware to support learning. 2.3.1: Select and use common applications. 2.4.1: Formulate and synthesize new knowledge.
Health and Fitness	
Math	N-Q1: 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. N-Q2: Define appropriate quantities for the purpose of descriptive modeling. N-Q3: Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. A-SSE1: Interpret expressions that represent a quantity in terms of its context. A-CED1: Create equations and inequalities in one variable and use them to solve problems. A-CED2: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. A-CED3: 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. A-CED4: Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. F-BF1: Write a function that describes a relationship between two quantities. F-LE1: Distinguish between situations that can be modeled with linear functions and with exponential functions. F-LE2: Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table). G-CO1: Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc G-MG1: Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder). G-MG2: Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). G-MG3: Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios). S-ID9: Distinguish between correlation and causation. S-ID9: Distinguish between correlation and causation. S-IC2: Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation.
Reading	9-10RI4: Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the cumulative impact of specific word choices on meaning and tone. 11-12RI4: Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze how an author uses and refines the meaning of a key term or terms over the course of a text.RI6-7: Integrate information presented in different media or formats (e.g., visually, quantitatively) as well as in words to develop a coherent understanding of a topic or issue. 9-10RI7: Analyze various accounts of a subject told in different mediums (e.g., a person's life story in both print and multimedia), determining which details are emphasized in each account. 11-12RI7: Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem. 9-10RST4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 9–10 texts and topics*. 11-12RST4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 11–12 texts and topics*. 9-10RST6: Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address.

	11-12RST6: Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved. 9-10RST9: Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts. 11-12RST9: 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. 9-10RST10: By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently. 11-12RST10: By the end of grade 12, read and comprehend science/technical texts in the grades 11–CCR text complexity band independently and proficiently.
Science	9-12SYSA: Feedback is a process in which the output of a system provides information used to regulate the operation of the system. Positive feedback increases the disturbance to a system. Negative feedback reduces the disturbance to a system. 9-12SYSB: Systems thinking can be especially useful in analyzing complex situations. To be useful, a system needs to be specified as clearly as possible. 9-12SYSC: In complex systems, entirely new and unpredictable properties may emerge. Consequently, modeling a complex system in sufficient detail to make reliable predictions may not be possible. 9-12INQC: Conclusions must be logical, based on evidence, and consistent with prior established knowledge. 9-12INQE: The essence of scientific investigation involves the development of a theory or conceptual model that can generate testable predictions. 9-12APPD: The ability to solve problems is greatly enhanced by use of mathematics and information technologies. 9-12APPE: Perfect solutions do not exist. All technological solutions involve trade-offs in which decisions to include more of one quality means less of another. All solutions involve consequences, some intended, others not. 9-11PS1A: Average velocity is defined as a change in position with respect to time. Velocity includes both speed and direction. 9-11PS1C: An object at rest will remain at rest unless acted on by an unbalanced force. An object in motion at constant velocity will continue at the same velocity unless acted on by an unbalanced force. (Newton's First Law of Motion, the Law of Inertia) 9-11 PS1H: Electricity and magnetism are two aspects of a single electromagnetic force. Moving electric charges produce magnetic forces, and moving magnets produce electric forces. 9-11PS3A: Although energy can be transferred from one object to another and can be transformed from one form of energy to another form, the total energy in a closed system remains the same. The concept of conservation of energy, applies to all physical and chemical changes. 9-11PS3D: Waves (including sound, seismic, light, and water waves) transfer energy when they interact with matter. Waves can have different wavelengths, frequencies, and amplitudes, and travel at different speeds. 9-11 PS3E: Electromagnetic waves differ from physical waves because they do not require a medium and they all travel at the same speed in a vacuum. This is the maximum speed that any object or wave can travel. Forms of electromagnetic waves include X-rays, ultraviolet, visible light, infrared, and radio.
Social Studies	
Writing	9-12WHST2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. 9-12WHST4: Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. 9-10WHST6: Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically. 11-12WHST6: 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. 9-12WHST10: 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.

Unit 12: Variables and Logic (using variables, math blocks and Boolean logic)

COMPONENTS AND ASSESSMENTS	
Performance Assessments: Student will design, build and program a robot that uses variable parameters, algebraic calculations and Boolean logic.	
Leadership Alignment: 1.1 Analyze, refine and apply decision-making skills; 1.3 Demonstrate oral, interpersonal, written and electronic communication and presentation skills; 1.4 Be involved in activities that require applying theory, problem-solving and using critical thinking skills while understanding the outcomes of related decisions; 2.1 Communicate, participate, and advocate effectively in pairs, small groups, teams and large groups in order to reach common goals; 2.6 Use knowledge, build interest, guide, influence decisions, organize efforts, and involve members of a group to assure that a pre-planned group activity is completed 2.B.1 Analyze how parts of a whole interact with each other to produce overall outcomes in complex systems	
Standards and Competencies	
Standard/Unit: Build and program robots that override block data with parameters passed from a Variable Block. Build and program robots that use algebraic combinations of multiple variables through Math Blocks. Build and program robots that use Boolean logic to control program flow.	
Competencies	**Total Learning Hours for Unit: 10**
• Describe the purpose of a Variable Block in NXT-G • Explain the parameters on the Variable Block • Program a robot to write and read variables • Program a robot to display variables on the NXT screen • Describe the purpose of a Math Block in NXT-G • Explain the parameters on the Math Block • Program a robot to respond to algebraic combinations of variables using Math Blocks • Describe the Boolean logic data type and operators in NXT-G • Explain the Boolean logic data plugs in various NXT-G blocks • Program a robot to respond to a logic-controlled Loop Block	
Aligned Common Core & Washington State Standards	
Art	
Communications	9-10SL1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grades 9–10 topics, texts, and issues,* building on others' ideas and expressing their own clearly and persuasively. 11-12SL1: Initiate and participate effectively in a range of collaborative discussions (one-on- one, in groups, and teacher-led) with diverse partners on *grades 11–12 topics, texts, and issues,* building on others' ideas and expressing their own clearly and persuasively. 9-10SL2: Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source. 11-12SL2: 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. 9-10SL4:Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task. 11-12SL4: Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks. 9-10SL5: Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance

	understanding of findings, reasoning, and evidence and to add interest. 11-12SL5: Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.
Educational Technology	1.1.1: Generate ideas and create original works for personal and group expression using a variety of digital tools. 1.1.2: Use models and simulations to explore systems, identify trends, and forecast possibilities. 1.2.1: Communicate and collaborate to learn with others. 1.3.2: Locate and organize information from a variety of sources and media. 1.3.4: Use multiple processes and diverse perspectives to explore alternative solutions 2.2.1: Develop skills to use technology effectively. 2.2.2: Use a variety of hardware to support learning. 2.3.1: Select and use common applications. 2.4.1: Formulate and synthesize new knowledge.
Health and Fitness	
Math	N-Q1: 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. N-Q2: Define appropriate quantities for the purpose of descriptive modeling. N-Q3: Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. A-SSE1: Interpret expressions that represent a quantity in terms of its context. A-CED1: Create equations and inequalities in one variable and use them to solve problems. A-CED2: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. A-CED3: 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. A-CED4: Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. A-REI3: Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. F-BF1: Write a function that describes a relationship between two quantities. F-LE1: Distinguish between situations that can be modeled with linear functions and with exponential functions. F-LE2: Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table). F-LE3: Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function. F-LE4: For exponential models, express as a logarithm the solution to abct = d where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology. F-LE5: Interpret the parameters in a linear or exponential function in terms of a context. G-CO1: Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc. G-SRT8: Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems. G-MG1: Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder). G-MG2: Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). G-MG3: Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios). S-ID1: Represent data with plots on the real number line (dot plots, histograms, and box plots). S-ID6: Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. S-ID7: Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. S-ID8: Compute (using technology) and interpret the correlation coefficient of a linear fit.

	S-ID9: Distinguish between correlation and causation. S-ID9: Distinguish between correlation and causation. S-IC2: Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. S-CP1: 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").
Reading	9-10RI4: Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the cumulative impact of specific word choices on meaning and tone. 11-12RI4: Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze how an author uses and refines the meaning of a key term or terms over the course of a text.RI6-7: Integrate information presented in different media or formats (e.g., visually, quantitatively) as well as in words to develop a coherent understanding of a topic or issue. 9-10RI7: Analyze various accounts of a subject told in different mediums (e.g., a person's life story in both print and multimedia), determining which details are emphasized in each account. 11-12RI7: Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem. 9-10RST4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 9–10 texts and topics*. 11-12RST4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 11–12 texts and topics*. 9-10RST6: Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address. 11-12RST6: Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved. 9-10RST9: Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts. 11-12RST9: 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. 9-10RST10: By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently. 11-12RST10: By the end of grade 12, read and comprehend science/technical texts in the grades 11–CCR text complexity band independently and proficiently.
Science	9-12SYSA: Feedback is a process in which the output of a system provides information used to regulate the operation of the system. Positive feedback increases the disturbance to a system. Negative feedback reduces the disturbance to a system. 9-12SYSB: Systems thinking can be especially useful in analyzing complex situations. To be useful, a system needs to be specified as clearly as possible. 9-12SYSC: In complex systems, entirely new and unpredictable properties may emerge. Consequently, modeling a complex system in sufficient detail to make reliable predictions may not be possible. 9-12INQC: Conclusions must be logical, based on evidence, and consistent with prior established knowledge. 9-12INQE: The essence of scientific investigation involves the development of a theory or conceptual model that can generate testable predictions. 9-12INQF: Science is a human endeavor that involves logical reasoning and creativity and entails the testing, revision, and occasional discarding of theories as new evidence comes to light. 9-12APPB: The technological design process begins by defining a problem in terms of criteria and constraints, conducting research, and generating several different solutions. 9-12APPC: Choosing the best solution involves comparing alternatives with respect to criteria and constraints, then building and testing a model or other representation of the final design. 9-12APPD: The ability to solve problems is greatly enhanced by use of mathematics and information technologies.

	9-12APPE: Perfect solutions do not exist. All technological solutions involve trade-offs in which decisions to include more of one quality means less of another. All solutions involve consequences, some intended, others not. 9-11PS1A: Average velocity is defined as a change in position with respect to time. Velocity includes both speed and direction. 9-11PS1C: An object at rest will remain at rest unless acted on by an unbalanced force. An object in motion at constant velocity will continue at the same velocity unless acted on by an unbalanced force. (Newton's First Law of Motion, the Law of Inertia) 9-11 PS1H: Electricity and magnetism are two aspects of a single electromagnetic force. Moving electric charges produce magnetic forces, and moving magnets produce electric forces. 9-11PS3A: Although energy can be transferred from one object to another and can be transformed from one form of energy to another form, the total energy in a closed system remains the same. The concept of conservation of energy, applies to all physical and chemical changes. 9-11PS3D: Waves (including sound, seismic, light, and water waves) transfer energy when they interact with matter. Waves can have different wavelengths, frequencies, and amplitudes, and travel at different speeds. 9-11 PS3E: Electromagnetic waves differ from physical waves because they do not require a medium and they all travel at the same speed in a vacuum. This is the maximum speed that any object or wave can travel. Forms of electromagnetic waves include X-rays, ultraviolet, visible light, infrared, and radio.
Social Studies	
Writing	9-12WHST2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. 9-12WHST4: Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. 9-10WHST6: Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically. 11-12WHST6: 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. 9-12WHST10: 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.

Unit 13: Data Logging with Sensors (using sensors for scientific experimentation)

COMPONENTS AND ASSESSMENTS	
Performance Assessments: Student will design experiments and program the NXT to perform scientific data logging of sensor readings	
Leadership Alignment: 1.1 Analyze, refine and apply decision-making skills 1.3 Demonstrate oral, interpersonal, written and electronic communication and presentation skills 1.4 Be involved in activities that require applying theory, problem-solving and using critical thinking skills while understanding the outcomes of related decisions 1.6 Conduct self in a professional manner in practical career applications, organizational forums, and decision-making goals; 2.1 Communicate, participate, and advocate effectively in pairs, small groups, teams and large groups in order to reach common goals 2.2 Demonstrate knowledge of conflict resolution and challenge management 2.6 Use knowledge, build interest, guide, influence decisions, organize efforts, and involve members of a group to assure that a pre-planned group activity is completed 8.A.1 Set goals with tangible and intangible success criteria	
Standards and Competencies	
Standard/Unit: Program the NXT to perform real time data logging with NXT sensors. Program the NXT to perform remote logging with NXT sensors. Program the NXT to perform data logging with advanced sensors. Analyze logged data with NXT-G analysis tools and spreadsheets. Design, build and program a robot to perform active data logging.	
Competencies	**Total Learning Hours for Unit: 10**
• Describe the role of data logging in the Scientific Method • Program the NXT to perform real time data logging with NXT sensors. • Program the NXT to perform remote logging with NXT sensors. • Program the NXT to perform data logging with advanced sensors (real time and remote) • Analyze logged data with NXT-G analysis tools • Upload logged data to a spreadsheet for advanced analysis • Program an embedded Data Logger into a NXT-G program • Design, build and program a robot to perform active data logging with NXT-G	
Aligned Common Core & Washington State Standards	
Art	
Communications	9-10SL1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grades 9–10 topics, texts, and issues,* building on others' ideas and expressing their own clearly and persuasively. 11-12SL1: Initiate and participate effectively in a range of collaborative discussions (one-on- one, in groups, and teacher-led) with diverse partners on *grades 11–12 topics, texts, and issues,* building on others' ideas and expressing their own clearly and persuasively. 9-10SL2: Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source. 11-12SL2: 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. 9-10SL4:Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task. 11-12SL4: Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style

	are appropriate to purpose, audience, and a range of formal and informal tasks. 9-10SL5: Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. 11-12SL5: Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.
Educational Technology	1.1.1: Generate ideas and create original works for personal and group expression using a variety of digital tools. 1.1.2: Use models and simulations to explore systems, identify trends, and forecast possibilities. 1.2.1: Communicate and collaborate to learn with others. 1.3.2: Locate and organize information from a variety of sources and media. 1.3.3: Analyze, synthesize and ethically use information to develop a solution, make informed decisions and report results 1.3.4: Use multiple processes and diverse perspectives to explore alternative solutions 2.2.1: Develop skills to use technology effectively. 2.2.2: Use a variety of hardware to support learning. 2.3.1: Select and use common applications. 2.4.1: Formulate and synthesize new knowledge.
Health and Fitness	
Math	N-Q1: 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. N-Q2: Define appropriate quantities for the purpose of descriptive modeling. N-Q3: Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. A-SSE1: Interpret expressions that represent a quantity in terms of its context. A-CED1: Create equations and inequalities in one variable and use them to solve problems. A-CED2: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. A-CED3: 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. A-CED4: Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. A-REI3: Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. F-IF1: 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*) denotes the output of *f* corresponding to the input *x*. The graph of *f* is the graph of the equation *y* = *f*(*x*). F-IF4: For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. F-IF5: Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. F-IF6: Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. F-IF7: Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. F-BF1: Write a function that describes a relationship between two quantities. F-LE1: Distinguish between situations that can be modeled with linear functions and with exponential functions. F-LE2: Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table). F-LE3: Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function. F-LE4: For exponential models, express as a logarithm the solution to abct = d where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.

	F-LE5: Interpret the parameters in a linear or exponential function in terms of a context. S-ID1: Represent data with plots on the real number line (dot plots, histograms, and box plots). S-ID6: Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. S-ID7: Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. S-ID8: Compute (using technology) and interpret the correlation coefficient of a linear fit. S-ID9: Distinguish between correlation and causation. S-ID9: Distinguish between correlation and causation. S-IC2: Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. S-CP1: 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").
Reading	9-10RI4: Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the cumulative impact of specific word choices on meaning and tone. 11-12RI4: Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze how an author uses and refines the meaning of a key term or terms over the course of a text.RI6-7: Integrate information presented in different media or formats (e.g., visually, quantitatively) as well as in words to develop a coherent understanding of a topic or issue. 9-10RI7: Analyze various accounts of a subject told in different mediums (e.g., a person's life story in both print and multimedia), determining which details are emphasized in each account. 11-12RI7: Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem. 9-10RST4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 9–10 texts and topics*. 11-12RST4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 11–12 texts and topics*. 9-10RST6: Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address. 11-12RST6: Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved. 9-10RST9: Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts. 11-12RST9: 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. 9-10RST10: By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently. 11-12RST10: By the end of grade 12, read and comprehend science/technical texts in the grades 11–CCR text complexity band independently and proficiently.
Science	9-12SYSA: Feedback is a process in which the output of a system provides information used to regulate the operation of the system. Positive feedback increases the disturbance to a system. Negative feedback reduces the disturbance to a system. 9-12SYSB: Systems thinking can be especially useful in analyzing complex situations. To be useful, a system needs to be specified as clearly as possible. 9-12SYSC: In complex systems, entirely new and unpredictable properties may emerge. Consequently, modeling a complex system in sufficient detail to make reliable predictions may not be possible. 9-12INQA: Scientists generate and evaluate questions to investigate the natural world. 9-12INQB: Investigate Scientific progress requires the use of various methods appropriate for answering different kinds of research questions, a thoughtful plan for gathering data needed to answer the question, and care in collecting, analyzing, and displaying the data. 9-12INQC: Conclusions must be logical, based on evidence, and consistent with prior established knowledge. **9-12 INQD Communicate Clearly** The methods and procedures that scientists use to obtain *evidence* must be clearly reported

	to enhance opportunities for further *investigation*. 9-12INQE: The essence of scientific investigation involves the development of a theory or conceptual model that can generate testable predictions. 9-12INQF: Science is a human endeavor that involves logical reasoning and creativity and entails the testing, revision, and occasional discarding of theories as new evidence comes to light. 9-12INQG: Public communication among scientists is an essential aspect of research. Scientists evaluate the validity of one another's investigations, check the reliability of results, and explain inconsistencies in findings. 9-12INQH: Scientists carefully evaluate sources of information for reliability before using that information. When referring to the ideas or findings of others, they cite their sources of information. 9-12APPB: The technological design process begins by defining a problem in terms of criteria and constraints, conducting research, and generating several different solutions. 9-12APPC: Choosing the best solution involves comparing alternatives with respect to criteria and constraints, then building and testing a model or other representation of the final design. 9-12APPD: The ability to solve problems is greatly enhanced by use of mathematics and information technologies. 9-12APPE: Perfect solutions do not exist. All technological solutions involve trade-offs in which decisions to include more of one quality means less of another. All solutions involve consequences, some intended, others not. 9-12APPF: It is important for all citizens to apply science and technology to critical issues that influence society. 9-11PS1A: Average velocity is defined as a change in position with respect to time. Velocity includes both speed and direction. 9-11PS1B: Average acceleration is defined as a change in velocity with respect to time. Acceleration indicates a change in speed and/or a change in direction. 9-11PS1C: An object at rest will remain at rest unless acted on by an unbalanced force. An object in motion at constant velocity will continue at the same velocity unless acted on by an unbalanced force. (Newton's First Law of Motion, the Law of Inertia). 9-11 PS1D A net force will cause an object to accelerate or change direction. A less massive object will speed up more quickly than a more massive object subjected to the same force. (Newton's Second Law of Motion, F=ma) 9-11 PS1E Whenever one object exerts a force on another object, a force of equal magnitude is exerted on the first object in the opposite direction. (Newton's Third Law of Motion) 9-11 PS1G: Electrical force is a force of nature independent of gravity that exists between charged objects. Opposite charges attract while like charges repel. 9-11 PS1H: Electricity and magnetism are two aspects of a single electromagnetic force. Moving electric charges produce magnetic forces, and moving magnets produce electric forces. 9-11PS2A: Atoms are composed of protons, neutrons, and electrons. The nucleus of an atom takes up very little of the atom's volume but makes up almost all of the mass. The nucleus contains protons and neutrons, which are much more massive than the electrons surrounding the nucleus. Protons have a positive charge, electrons are negative in charge, and neutrons have no net charge. 9-11 PS2G: Chemical reactions change the arrangement of atoms in the molecules of substances. Chemical reactions release or acquire energy from their surroundings and result in the formation of new substances. 9-11 PS2H: Solutions are mixtures in which particles of one substance are evenly distributed through another substance. Liquids are limited in the amount of dissolved solid or gas that they can contain. Aqueous solutions can be described by relative quantities of the dissolved substances and acidity or alkalinity (pH). 9-11 PS2I: The rate of a physical or chemical change may be affected by factors such as temperature, surface area, and pressure. 9-11PS3A: Although energy can be transferred from one object to another and can be transformed from one form of energy to another form, the total energy in a closed system remains the same. The concept of conservation of energy, applies to all physical and chemical changes. 9-11 PS3B: Kinetic energy is the energy of motion. The kinetic energy of an object is defined by the equation: Ek = 1/2 mv2 9-11 PS3C: Gravitational potential energy is due to the separation of mutually attracting masses. Transformations can occur between gravitational potential energy and kinetic energy, but the total amount of energy remains constant. 9-11PS3D: Waves (including sound, seismic, light, and water waves) transfer energy when they interact with matter. Waves can have

	different wavelengths, frequencies, and amplitudes, and travel at different speeds. 9-11 PS3E: Electromagnetic waves differ from physical waves because they do not require a medium and they all travel at the same speed in a vacuum. This is the maximum speed that any object or wave can travel. Forms of electromagnetic waves include X-rays, ultraviolet, visible light, infrared, and radio. 9-11 ES2B: Climate is determined by energy transfer from the sun at and near Earth's surface. This energy transfer is influenced by dynamic processes such as cloud cover and Earth's rotation, as well as static conditions such as proximity to mountain ranges and the ocean. Human activities, such as burning of fossil fuels, also affect the global climate. 9-11 LS1A: Carbon-containing compounds are the building blocks of life. Photosynthesis is the process that plant cells use to combine the energy of sunlight with molecules of carbon dioxide and water to produce energy-rich compounds that contain carbon (food) and release oxygen.
Social Studies	
Writing	9-12WHST2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. 9-12WHST4: Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. 9-12WHST5: 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. 9-10WHST6: Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically. 11-12WHST6: 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. 9-12WHST10: 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.

Unit 14: Software Design for Competition (FIRST® Tech Challenge)

COMPONENTS AND ASSESSMENTS	
Performance Assessments: Student will program Tetrix robots for competition in the *FIRST*® Tech Challenge	
Leadership Alignment: 1.1 Analyze, refine and apply decision-making skills 1.3 Demonstrate oral, interpersonal, written and electronic communication and presentation skills 1.4 Be involved in activities that require applying theory, problem-solving and using critical thinking skills while understanding the outcomes of related decisions 1.6 Conduct self in a professional manner in practical career applications, organizational forums, and decision-making goals; 2.1 Communicate, participate, and advocate effectively in pairs, small groups, teams and large groups in order to reach common goals 2.2 Demonstrate knowledge of conflict resolution and challenge management 2.6 Use knowledge, build interest, guide, influence decisions, organize efforts, and involve members of a group to assure that a pre-planned group activity is completed 8.C.4 Reflect critically on past experiences in order to inform future progress	
Standards and Competencies	
Standard/Unit: Create autonomous RobotC programs for Tetrix robots competing in the FIRST® Tech Challenge Create RobotC programs for Tetrix robots competing in the FIRST® Tech Challenge	
Competencies	**Total Learning Hours for Unit: 20**
• Demonstrate proficiency with the setup and use of the FTC Samantha module • Demonstrate proficiency with the setup and use of the FTC Field Control System • Demonstrate proficiency with use of the FTC competition software templates • Demonstrate proficiency with use of the FTC competition software checklist • Write, test and debug programs for multiple FTC autonomous mode scenarios • Write, test and debug programs for FTC teleop mode operations • Demonstrate proficiency with software management techniques, including revision, backup, quality and reliability controls	
Aligned Common Core & Washington State Standards	
Art	
Communications	9-10SL1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grades 9–10 topics, texts, and issues,* building on others' ideas and expressing their own clearly and persuasively. 11-12SL1: Initiate and participate effectively in a range of collaborative discussions (one-on- one, in groups, and teacher-led) with diverse partners on *grades 11–12 topics, texts, and issues,* building on others' ideas and expressing their own clearly and persuasively. 9-10SL2: Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source. 11-12SL2: 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. 9-10SL 4:Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task. 11-12SL 4: Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks. 9-10SL5: Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. 11-12SL5: Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.

Educational Technology	1.1.1: Generate ideas and create original works for personal and group expression using a variety of digital tools. 1.1.2: Use models and simulations to explore systems, identify trends, and forecast possibilities. 1.2.1: Communicate and collaborate to learn with others. 1.3.2: Locate and organize information from a variety of sources and media. 1.3.3: Analyze, synthesize and ethically use information to develop a solution, make informed decisions and report results 1.3.4: Use multiple processes and diverse perspectives to explore alternative solutions 2.2.1: Develop skills to use technology effectively. 2.2.2: Use a variety of hardware to support learning. 2.3.1: Select and use common applications. 2.4.1: Formulate and synthesize new knowledge.
Health and Fitness	
Math	N-Q1: 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. N-Q2: Define appropriate quantities for the purpose of descriptive modeling. N-Q3: Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. A-SSE1: Interpret expressions that represent a quantity in terms of its context. A-CED1: Create equations and inequalities in one variable and use them to solve problems. A-CED3: 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. A-CED4: Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. A-REI3: Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. F-IF1: 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*) denotes the output of *f* corresponding to the input *x*. The graph of *f* is the graph of the equation *y* = *f*(*x*). F-IF4: For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. F-IF5: Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. F-IF6: Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. F-BF1: Write a function that describes a relationship between two quantities. F-LE1: Distinguish between situations that can be modeled with linear functions and with exponential functions. F-LE2: Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table). F-LE3: Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function. F-LE4: For exponential models, express as a logarithm the solution to abct = d where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology. F-LE5: Interpret the parameters in a linear or exponential function in terms of a context. G-CO1: Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc. G-SRT8: Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems. G-GPE7: Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula. G-MG1: Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder). G-MG2: Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). G-MG3: Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or

	minimize cost; working with typographic grid systems based on ratios). S-ID1: Represent data with plots on the real number line (dot plots, histograms, and box plots). S-ID6: Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. S-ID7: Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. S-ID8: Compute (using technology) and interpret the correlation coefficient of a linear fit. S-ID9: Distinguish between correlation and causation. S-IC2: Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. S-CP1: 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"). S-CP2: 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.
Reading	9-10RI4: Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the cumulative impact of specific word choices on meaning and tone. 11-12RI4: Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze how an author uses and refines the meaning of a key term or terms over the course of a text. 9-10RI 7: Analyze various accounts of a subject told in different mediums (e.g., a person's life story in both print and multimedia), determining which details are emphasized in each account. 11-12RI7: Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem. 9-10RST1: Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. 11-12RST1: Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. 11-12RST6: Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved. 9-10RST7: Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. 11-12RST7: 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. 9-10RST9: Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts. 11-12RST9: 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. 9-10RST10: By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently. 11-12RST10: By the end of grade 12, read and comprehend science/technical texts in the grades 11–CCR text complexity band independently and proficiently.
Science	9-12SYSA: Feedback is a process in which the output of a system provides information used to regulate the operation of the system. Positive feedback increases the disturbance to a system. Negative feedback reduces the disturbance to a system. 9-12SYSB: Systems thinking can be especially useful in analyzing complex situations. To be useful, a system needs to be specified as clearly as possible. 9-12SYSC: In complex systems, entirely new and unpredictable properties may emerge. Consequently, modeling a complex system in sufficient detail to make reliable predictions may not be possible. 9-12INQC: Conclusions must be logical, based on evidence, and consistent with prior established knowledge. 9-12INQE: The essence of scientific investigation involves the development of a theory or conceptual model that can generate testable predictions.

	9-12INQF: Science is a human endeavor that involves logical reasoning and creativity and entails the testing, revision, and occasional discarding of theories as new evidence comes to light. 9-12INQG: Public communication among scientists is an essential aspect of research. Scientists evaluate the validity of one another's investigations, check the reliability of results, and explain inconsistencies in findings. 9-12INQH: Scientists carefully evaluate sources of information for reliability before using that information. When referring to the ideas or findings of others, they cite their sources of information. 9-12APPB: The technological design process begins by defining a problem in terms of criteria and constraints, conducting research, and generating several different solutions. 9-12APPC: Choosing the best solution involves comparing alternatives with respect to criteria and constraints, then building and testing a model or other representation of the final design. 9-12APPD: The ability to solve problems is greatly enhanced by use of mathematics and information technologies. 9-12APPE: Perfect solutions do not exist. All technological solutions involve trade-offs in which decisions to include more of one quality means less of another. All solutions involve consequences, some intended, others not. 9-12APPF: It is important for all citizens to apply science and technology to critical issues that influence society. 9-11PS1A: Average velocity is defined as a change in position with respect to time. Velocity includes both speed and direction. 9-11PS1B: Average acceleration is defined as a change in velocity with respect to time. Acceleration indicates a change in speed and/or a change in direction. 9-11PS1C: An object at rest will remain at rest unless acted on by an unbalanced force. An object in motion at constant velocity will continue at the same velocity unless acted on by an unbalanced force. (Newton's First Law of Motion, the Law of Inertia) 9-11 PS1G: Electrical force is a force of nature independent of gravity that exists between charged objects. Opposite charges attract while like charges repel. 9-11 PS1H: Electricity and magnetism are two aspects of a single electromagnetic force. Moving electric charges produce magnetic forces, and moving magnets produce electric forces. 9-11PS3A: Although energy can be transferred from one object to another and can be transformed from one form of energy to another form, the total energy in a closed system remains the same. The concept of conservation of energy, applies to all physical and chemical changes. 9-11PS3D: Waves (including sound, seismic, light, and water waves) transfer energy when they interact with matter. Waves can have different wavelengths, frequencies, and amplitudes, and travel at different speeds. 9-11 PS3E: Electromagnetic waves differ from physical waves because they do not require a medium and they all travel at the same speed in a vacuum. This is the maximum speed that any object or wave can travel. Forms of electromagnetic waves include X-rays, ultraviolet, visible light, infrared, and radio.
Social Studies	
Writing	9-12WHST2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. 9-12WHST4: Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. 9-12WHST5: 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. 9-10WHST6: Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically. 11-12WHST6: 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. 9-12WHST10: 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.

Unit 15: Hardware Design for Competition (FIRST® Tech Challenge)

COMPONENTS AND ASSESSMENTS	
Performance Assessments: Student will build Tetrix robots for competition in the *FIRST*® Tech Challenge	
Leadership Alignment: 1.1 Analyze, refine and apply decision-making skills 1.3 Demonstrate oral, interpersonal, written and electronic communication and presentation skills 1.4 Be involved in activities that require applying theory, problem-solving and using critical thinking skills while understanding the outcomes of related decisions 1.6 Conduct self in a professional manner in practical career applications, organizational forums, and decision-making goals; 2.1 Communicate, participate, and advocate effectively in pairs, small groups, teams and large groups in order to reach common goals 2.2 Demonstrate knowledge of conflict resolution and challenge management 2.6 Use knowledge, build interest, guide, influence decisions, organize efforts, and involve members of a group to assure that a pre-planned group activity is completed 7.B.1 Deal positively with praise, setbacks and criticism 7.B.2 Understand, negotiate and balance diverse views and beliefs to reach workable solutions,	
Standards and Competencies	
Standard/Unit: Build Tetrix robot for autonomous and teleop operations in the *FIRST*® Tech Challenge	
Competencies	**Total Learning Hours for Unit: 20**
• Demonstrate proficiency with the setup and use of the FTC Samantha module • Demonstrate proficiency with the setup and use of the FTC Field Control System • Demonstrate proficiency with use of the FTC competition hardware checklist • Design, build and test Tetrix robot for FTC autonomous mode scenarios • Design, build and test Tetrix robot for FTC teleop mode operations • Demonstrate proficiency with competitive hardware management techniques, including risk management, redundancy, fault tolerance, quality/reliability controls	
Aligned Common Core & Washington State Standards	
Art	
Communications	9-10SL1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grades 9–10 topics, texts, and issues,* building on others' ideas and expressing their own clearly and persuasively. 11-12SL1: Initiate and participate effectively in a range of collaborative discussions (one-on- one, in groups, and teacher-led) with diverse partners on *grades 11–12 topics, texts, and issues,* building on others' ideas and expressing their own clearly and persuasively. 9-10SL2: Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source. 11-12SL2: 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. 9-10SL4:Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task. 11-12SL4: Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks. 9-10SL5: Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. 11-12SL5: Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.

Educational Technology	1.1.1: Generate ideas and create original works for personal and group expression using a variety of digital tools. 1.1.2: Use models and simulations to explore systems, identify trends, and forecast possibilities. 1.2.1: Communicate and collaborate to learn with others. 1.3.2: Locate and organize information from a variety of sources and media. 1.3.3: Analyze, synthesize and ethically use information to develop a solution, make informed decisions and report results 1.3.4: Use multiple processes and diverse perspectives to explore alternative solutions 2.2.1: Develop skills to use technology effectively. 2.2.2: Use a variety of hardware to support learning. 2.3.1: Select and use common applications. 2.4.1: Formulate and synthesize new knowledge.
Health and Fitness	
Math	N-Q1: 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. N-Q2: Define appropriate quantities for the purpose of descriptive modeling. N-Q3: Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. A-SSE1: Interpret expressions that represent a quantity in terms of its context. A-CED1: Create equations and inequalities in one variable and use them to solve problems. A-CED3: 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. A-CED4: Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. A-REI3: Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. F-IF1: 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*) denotes the output of *f* corresponding to the input *x*. The graph of *f* is the graph of the equation *y* = *f*(*x*). F-IF4: For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. F-IF5: Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. F-IF6: Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. F-BF1: Write a function that describes a relationship between two quantities. F-LE1: Distinguish between situations that can be modeled with linear functions and with exponential functions. F-LE2: Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table). F-LE3: Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function. F-LE4: For exponential models, express as a logarithm the solution to abct = d where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology. F-LE5: Interpret the parameters in a linear or exponential function in terms of a context. G-CO1: Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc. G-SRT8: Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems. G-GPE7: Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula. G-MG1: Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder). G-MG2: Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). G-MG3: Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or

	minimize cost; working with typographic grid systems based on ratios). S-ID1: Represent data with plots on the real number line (dot plots, histograms, and box plots). S-ID6: Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. S-ID7: Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. S-ID8: Compute (using technology) and interpret the correlation coefficient of a linear fit. S-ID9: Distinguish between correlation and causation. S-IC2: Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. S-CP1: 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"). S-CP2: 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.
Reading	9-10RI4: Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the cumulative impact of specific word choices on meaning and tone. 11-12RI4: Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze how an author uses and refines the meaning of a key term or terms over the course of a text. 9-10RI7: Analyze various accounts of a subject told in different mediums (e.g., a person's life story in both print and multimedia), determining which details are emphasized in each account. 11-12RI7: Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem. 9-10RST1: Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. 11-12RST1: Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. 9-10RST3: Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. 11-12RST3: Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. 9-10RST4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 9–10 texts and topics*. 11-12RST4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 11–12 texts and topics*. 9-10RST6: Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address. 11-12RST6: Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved. 9-10RST7: Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. 11-12RST7: 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. 9-10RST9: Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts. 11-12RST9: 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. 9-10RST10: By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently. 11-12RST10: By the end of grade 12, read and comprehend science/technical texts in the grades 11–CCR text complexity band

	independently and proficiently.
Science	9-12SYSA: Feedback is a process in which the output of a system provides information used to regulate the operation of the system. Positive feedback increases the disturbance to a system. Negative feedback reduces the disturbance to a system. 9-12SYSB: Systems thinking can be especially useful in analyzing complex situations. To be useful, a system needs to be specified as clearly as possible. 9-12SYSC: In complex systems, entirely new and unpredictable properties may emerge. Consequently, modeling a complex system in sufficient detail to make reliable predictions may not be possible. 9-12INQA: Scientists generate and evaluate questions to investigate the natural world. 9-12INQC: Conclusions must be logical, based on evidence, and consistent with prior established knowledge. 9-12INQE: The essence of scientific investigation involves the development of a theory or conceptual model that can generate testable predictions. 9-12APPF: It is important for all citizens to apply science and technology to critical issues that influence society. 9-11PS1A: Average velocity is defined as a change in position with respect to time. Velocity includes both speed and direction. 9-11PS1B: Average acceleration is defined as a change in velocity with respect to time. Acceleration indicates a change in speed and/or a change in direction. 9-11PS1C: An object at rest will remain at rest unless acted on by an unbalanced force. An object in motion at constant velocity will continue at the same velocity unless acted on by an unbalanced force. (Newton's First Law of Motion, the Law of Inertia) 9-11 PS1G: Electrical force is a force of nature independent of gravity that exists between charged objects. Opposite charges attract while like charges repel. 9-11 PS1H: Electricity and magnetism are two aspects of a single electromagnetic force. Moving electric charges produce magnetic forces, and moving magnets produce electric forces. 9-11PS2A: Atoms are composed of protons, neutrons, and electrons. The nucleus of an atom takes up very little of the atom's volume but makes up almost all of the mass. The nucleus contains protons and neutrons, which are much more massive than the electrons surrounding the nucleus. Protons have a positive charge, electrons are negative in charge, and neutrons have no net charge. 9-11PS3A: Although energy can be transferred from one object to another and can be transformed from one form of energy to another form, the total energy in a closed system remains the same. The concept of conservation of energy, applies to all physical and chemical changes. 9-11PS3D: Waves (including sound, seismic, light, and water waves) transfer energy when they interact with matter. Waves can have different wavelengths, frequencies, and amplitudes, and travel at different speeds. 9-11 PS3E: Electromagnetic waves differ from physical waves because they do not require a medium and they all travel at the same speed in a vacuum. This is the maximum speed that any object or wave can travel. Forms of electromagnetic waves include X-rays, ultraviolet, visible light, infrared, and radio.
Social Studies	
Writing	9-12WHST2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. 9-12WHST4: Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. 9-12WHST5: 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. 9-10WHST6: Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically. 11-12WHST6: 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. 9-12WHST10: 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.

The 21st Century Skills should be taught and assessed throughout the course. This table should be included at the end of this document.

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 ☒**U**se 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