

## Auburn School District Frameworks: Robotics Technology

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

**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
- 21<sup>st</sup> Century Skills (Leadership)
- Local Advisory Board

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

Performance Assessment		
Student will demonstrate kr	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 app	ly decision-making skills	
1.3 Demonstrate oral, interp	personal, 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 profes	sional 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	
Stondard/Unit:	Standards and Competencies	
Standard/Unit:	presedures in a NVT Debatics lab	
Identify STEM encore and	procedures in a NAT Robolics lab.	
	patriways.	
	faturiales in a NVT Dataties lat	
Identify health and sa	Arety risks in a NXT Robotics lab	
Explain health and sa	arety procedures which address risks in a NXT Robotics lab	
Identify health and sa	itety risks in a Tetrix Robotics lab	
Explain nealth and sa	arety procedures which address risks in a Tetrix Rodotics lab	
Describe the breadth	of possible STEM careers	
Identify and explore a	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.	
	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	
Communications	the data.	
Communications	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.	
	1.3.2: Locate and organize information from a variety of sources and media.	
Educational Technology	2.2.1: Develop skills to use technology effectively.	
	2.2.2: Use a variety of hardware to support learning	
Health and Fitness		
	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.	
Math	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	<ul> <li>9-10RST1: Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.</li> <li>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.</li> <li>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.</li> <li>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.</li> <li>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.</li> <li>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.</li> </ul>	
Science	<ul> <li>Process, phenomenon, or concept, resolving conflicting information when possible.</li> <li>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.</li> <li>9-12 SYSB: Systems thinking can be especially useful in analyzing complex situations. To be useful, a system needs to be specified a clearly as possible.</li> <li>9-12 SYSC: In complex systems, entirely new and unpredictable properties may emerge. Consequently, modeling a complex system sufficient detail to make reliable predictions may not be possible.</li> <li>9-12 APPB: The technological design process begins by defining a problem in terms of criteria and constraints, conducting research, generating several different solutions.</li> <li>9-12 APPC: Choosing the best solution involves comparing alternatives with respect to criteria and constraints, then building and testi model or other representation of the final design.</li> <li>9-12 APPC: The ability to solve problems is greatly enhanced by use of mathematics and information technologies.</li> <li>9-12 APPE: Perfect solutions involve consequences, some intended, others not.</li> <li>9-12 APPF: It is important for all citizens to apply science and technology to critical issues that influence society.</li> <li>9-11 PS1G: Electricit and magnetism are two aspects of a single electromagnetic force. Moving electric charges produce magnetic forces, and moving magnets produce electric forces.</li> <li>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.</li> <li>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.</li> <li>9-11 PS1H: Electricity and magnetism are two</li></ul>	
Social Studies		
Writing	<ul> <li>9-12WHST2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.</li> <li>9-12WHST4: Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.</li> <li>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.</li> <li>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.</li> </ul>	

## **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

**Total Learning Hours for Unit: 15** 

## Standard/Unit:

Describe characteristics of robots and explain/use NXT components

#### Competencies

- 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	<ul> <li>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.</li> <li>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.</li> <li>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.</li> <li>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.</li> <li>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.</li> <li>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, substance, and style are appropriate to purpose, audience, substance, and style are appropriate to purpose, audience, and task.</li> </ul>	
Educational Technology	<ul><li>1.1.1: Generate ideas and create original works for personal and group expression using a variety of digital tools.</li><li>1.2.1: Communicate and collaborate to learn with others.</li><li>1.3.2: Locate and organize information from a variety of sources and media.</li></ul>	
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.	
	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.	
	9-10RS11: 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-TORSTS. Follow precisely a complex multislep procedure when carrying out experiments, taking measurements, or performing technical	
Reading	11-12PST3: Follow procisely 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.	
	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.	
	model or other representation of the final design	
Science	9-12APPD: The ability to solve problems is greatly enhanced by use of mathematics and information technologies	
Obienide	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	<ul> <li>9-12WHST2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.</li> <li>9-12WHST4: Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.</li> <li>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.</li> <li>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.</li> <li>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.</li> <li>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.</li> </ul>	

## 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

**Total Learning Hours for Unit: 10** 

Standard/Unit:

Build Robotic circuits and run robotics programs

## Competencies

- 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	<ul> <li>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.</li> <li>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.</li> <li>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.</li> <li>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</li> </ul>	
Educational Technology	<ul><li>1.2.1: Communicate and collaborate to learn with others.</li><li>2.2.1: Develop skills to use technology effectively.</li><li>2.2.2: Use a variety of hardware to support learning.</li></ul>	
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,	
	guadratically, 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.	
	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	
Reading	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 <sup>-</sup> 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	
	9-12SYSA: 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 nossible	
	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	
	Q-12APPB: The technological design process begins by defining a problem in terms of criteria and constraints, conducting research, and	
	denerating several different solutions	
	9-12APPC: Choosing the best solution involves comparing alternatives with respect to criteria and constraints, then building and testing a	
Science	model or other representation of the final design	
Science	Q-12APPD: The ability to solve problems is greatly enhanced by use of mathematics and information technologies	
	Q-12APPE: Perfect solutions do not exist. All technological solutions involve trade-offs in which decisions to include more of one quality	
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	9-12RFFF. It is important for all clitzens to apply science and technology to childar issues that inductive society.	
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	INE Unarges reper.	
	9-11-51n. Electricity and magnetism are two aspects of a single electromagnetic force. Moving electric charges produce magnetic forces,	
	and moving magnets produce electric forces.	
	19-11PSZA: 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	<ul> <li>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.</li> <li>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.</li> <li>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.</li> </ul>

#### 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

**Total Learning Hours for Unit: 10** 

## Standard/Unit:

Understand the roles of hardware, software and firmware, and how they interact in the NXT

#### Competencies

- 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 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, guantitatively, orally) evaluating Communications 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. 1.2.1: Communicate and collaborate to learn with others. Educational Technology 2.2.1: Develop skills to use technology effectively. 2.2.2: Use a variety of hardware to support learning. Health and Fitness 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. Math 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. 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 Reading 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

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	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
Science	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	
	9-12WHST2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or
Writing	technical processes.
Witting	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 Assessment	S: straight movement of a robot through programming parameters	
	straight movement of a robot through programming parameters	
1 1 Analyze refine and ann	ly decision-making skills	
1.1 Analyze, refine and app	that require applying theory, problem-solving and using critical thinking skills while understand	ing the outcomes of related decisions
2.1 Communicate particina	te and advocate effectively in pairs small groups teams and large groups in order to reach co	ammon doals
3 B 2 Exercise flexibility ar	willingness to be beleful in making necessary compromises to accomplish a common goal	innon goalo
	id winingness 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 relation	tionship between power level and travel time/speed	
Competencies		Total Learning Hours for Unit: 13
<ul> <li>Manipulate the Video</li> </ul>	Trainer software	
<ul> <li>Download a program</li> </ul>	from NXT-G to a robot	
<ul> <li>Calculate program participation</li> </ul>	rameters based on the circumference of a circle	
<ul> <li>Program a robot for p</li> </ul>	recision forward and reverse motion	
<ul> <li>Measure, plot and int</li> </ul>	erpolate travel time vs power level data	
<ul> <li>Calculate, plot and in</li> </ul>	terpolate speed vs power level data	
	Aligned Common Core & Washington State Standards	
Art		
Communications	<ul> <li>9-10SL1: Initiate and participate effectively in a range of collaborative discussions (one-on-on partners on grades 9–10 topics, texts, and issues, building on others' ideas and expressing the 11-12SL1: Initiate and participate effectively in a range of collaborative discussions (one-on-on partners on grades 11–12 topics, texts, and issues, building on others' ideas and expressing 9-10SL2: Integrate multiple sources of information presented in diverse media or formats (e.g. the credibility and accuracy of each source.</li> <li>11-12SL2: Integrate multiple sources of information presented in diverse formats and media to make informed decisions and solve problems, evaluating the credibility and accuracy of each source.</li> <li>9-10SL5: Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interaunderstanding of findings, reasoning, and evidence and to add interest.</li> <li>11-12SL5: Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interaunderstanding of findings, reasoning, and evidence and to add interest.</li> </ul>	he, in groups, and teacher-led) with diverse heir own clearly and persuasively. one, in groups, and teacher-led) with diverse their own clearly and persuasively. g., visually, quantitatively, orally) evaluating (e.g., visually, quantitatively, orally) in order ch source and noting any discrepancies active elements) in presentations to enhance ractive elements) in presentations to enhance
	1.1.1.1. Generate ideas and create original works for personal and group expression using a va	ariety of digital tools
	1.1.2: Use models and simulations to explore systems, identify trends, and forecast possibiliti	es.
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 in formulas; choose and interpret the scale and the origin in graphs and data displays.	plems; choose and interpret units consistently

	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-IE6: 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
	E-BE1: 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
	noint 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 torse as a
	g-work of the states, their measures, and their properties to describe objects (e.g., modeling a tree truth of a number to so as a subjects)
	Cyllinder). S ID1: Penregent data with plate on the real number line (dat plate, biotegrame, and hav plate)
	S-IDT. 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.
	9-10R14: 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
Reading	or descriptions.
Roading	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.
	9-12SYSA: 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
Salanaa	clearly as possible.
Science	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 guestions 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 numan endeavor that involves logical reasoning and creativity and entails the testing, revision, and occasional discarding of theories as new evidence comes to light
	9-12INOG: 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: Period solutions do not exist. All technological solutions involve trade-oils in which decisions to include more of one quality
	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	
	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
Writing	audience.
	- 12WHSTS. Develop and strengthen whiting as needed by planning, revising, editing, rewhiting, or trying a new approach, rocusing 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 Assessmen	ts:		
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 app	bly decision-making skills		
1.3 Demonstrate oral, inter	personal, written and electronic communication and presentation s	kills	
1.4 Be involved in activities	that require applying theory, problem-solving and using critical thir	nking skills while understanding the outcomes of related decisions	
2.1 Communicate, participa	ate, and advocate effectively in pairs, small groups, teams and large	e groups in order to reach common goals	
2.2 Demonstrate knowledge	e of conflict resolution and challenge management		
2.6 Use knowledge, build ir	terest, guide, influence decisions, organize efforts, and involve me	mbers of a group to assure that a pre-planned group activity is completed	
8.C.1 Go beyond basic ma	astery of skills and/or curriculum to explore and expand one's own	learning and opportunities to gain expertise	
	Standards and Competer	encies	
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 parame	eter of the light sensor configuration panel		
Calculate a light sense	sor threshold		
Program a robot to re	espond to the light sensor		
Explain each parame	<ul> <li>Explain each parameter of the sound block (audible output) configuration panel</li> </ul>		
Program a robot to re	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 se	Explain the timing sensitivity of the sound sensor		
Explain gearing up and down in relation to speed and torgue			
Calculate gear ratios			
Describe the difference between Science and Engineering			
<ul> <li>Build a robot using the Engineering Process which incorporates precision forward motion, gear ratios, light and sound sensors</li> </ul>			
Aligned Common Core & Washington State Standards			
Art			
	9-10SL1: Initiate and participate effectively in a range of collabor	ative discussions (one-on-one, in groups, and teacher-led) with diverse	
	partners on grades 9-10 topics, texts, and issues, building on oth	ners' ideas and expressing their own clearly and persuasively.	
	11-12SL1: Initiate and participate effectively in a range of collabo	prative discussions (one-on- one, in groups, and teacher-led) with diverse	
Communications	partners on grades 11-12 topics, texts, and issues, building on c	thers' ideas and expressing their own clearly and persuasively.	
	9-10SL2: Integrate multiple sources of information presented in c	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 cre	dibility 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.
	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.
Educational Technology	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	
	NO1: Use units as a way to understand problems and to guide the solution of multi-step problems: sheeps and interpret units consistently.
	in formulae: choose and interpret the scale and the origin in graphs and data displays
	In formulas, choose and interpret the scale and the origin in graphs and data displays.
	N-Q2. Chapped a level of accuracy appropriate to limitations on maccurament when reporting quantities
	N-Q3: Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
	A-55E1. Interpret expressions that represent a quantity in terms of its context.
Math	A-CEDT: Create equations and inequalities in one variable and use them to solve problems. A-CED3: Represent constraints by equations
Wath	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 of nonviable options in a modeling context.
	A-CED4. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.
	5-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.
	9-TORIA: Determine the meaning of words and phrases as they are used in a text, including ligurative, connotative, and technical
	14.12D14. Determine the meaning of words and phrases as they are used in a text including figurative, connectative, and technical
	TI-12R14. Determine the meaning of words and pricases as they are used in a text, including figurative, connotative, and technical
	meanings; analyze now an author uses and relines the meaning of a key term or terms over the course of a text.
<b>.</b>	9-TORT7. Analyze valious 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
Reading	well as in words in order to address a question or solve a problem.
	9-10RS11: Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations
	or descriptions.
	11-12RS11: Lite 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.
	s rollow 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.
	11-12K513: 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.
	9-10RS110: By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently
	and proticiently.
	11-12RS110: By the end of grade 12, read and comprehend science/technical texts in the grades 11–CCR text complexity band
	Independently and proliciently.
	9-12515A. Feedback is a process in which the output of a system provides information used to regulate the operation of the system.
	Positive recuback increases the disturbance to a system. Negative recuback reduces the disturbance to a system.
	elearly of possible
	0-12SVSC: 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
	0.12INOA: Scientists generate and evaluate guestions to investigate the natural world
	9-12INQA. Scientists generate and evaluate questions to investigate the natural world.
	9-12INQC. Conclusions must be logical, based on evidence, and consistent with phot established knowledge. 9-12INQF: The essence of scientific investigation involves the development of a theory or conceptual model that can generate testable
	predictions
	9-12INOF: 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.
	9-12INOG: 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.
Science	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)

	0.44 DC411. Electricity and momentian are two concepts of a single electromomentia force. Maying electric sharpes and the momentia
	9-11 Point: 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	
	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.
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
	9-12/WHST10: 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 discipling-specific tasks, purposes, and audionces
	or two/ for a range of discipline-specific tasks, purposes, and addictices.

## 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		
<ul> <li>Explain how each pa</li> </ul>	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			
<ul> <li>Write a program for a</li> </ul>	a robot to maneuver with various precision turns		
<ul> <li>Write a program for a</li> </ul>	a robot to combine turning and sensor response		
<ul> <li>Create a flowchart to</li> </ul>	Create a flowchart to represent a multi-step activity		
<ul> <li>Develop a robot prog</li> </ul>	ram from a flow chart		
<ul> <li>Explain each parame</li> </ul>	eter of the Motor Block		
<ul> <li>Write a program usin</li> </ul>	g the Motor Block to control a third motor in a robot		
<ul> <li>Design, build and pro</li> </ul>	ogram 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	<ul> <li>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.</li> <li>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.</li> <li>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.</li> <li>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.</li> <li>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.</li> <li>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.</li> <li>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.</li> <li>11-12SL5: Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance</li></ul>		
Educational Technology	<ul> <li>1.1.2: Use models and simulations to explore systems, identify trends, and forecast possibilities.</li> <li>1.3.2: Locate and organize information from a variety of sources and media.</li> <li>1.3.4: Use multiple processes and diverse perspectives to explore alternative solutions</li> </ul>		
Health and Fitness			
Math	<ul> <li>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.</li> <li>N-Q2: Define appropriate quantities for the purpose of descriptive modeling.</li> <li>N-Q3: Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.</li> <li>A-SSE1: Interpret expressions that represent a quantity in terms of its context.</li> <li>A-CED1: Create equations and inequalities in one variable and use them to solve problems.</li> <li>A-CED2: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.</li> <li>A-CED3: Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable options in a modeling context.</li> <li>A-CED4: Pearronge formulas to biblight a quantity of interest, using the same reasoning as in solving equations.</li> </ul>		

	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
	9-1021. Decide in a specified model is consistent with results from a given data generating process, e.g., doing simulation.
	meaning: analyze the cumulative impact of specific word choices on meaning and tone
	11 12PI4: Determine the meaning of words and phrases as they are used in a text, including figurative, connectative, and technical
	meaning of a low on author was and refines the meaning of a low term or terms over the source of a text.
	a construction of a text.
	9-10R17: 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
Pooding	technical tasks; analyze the specific results based on explanations in the text.
Reading	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.
<u> </u>	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.
Science	a-128VSB: Systems thinking can be especially useful in analyzing complex situations. To be useful, a system needs to be especially useful in analyzing complex situations. To be useful, a system needs to be especially useful as
	doarly 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
	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	
	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
	9-12WHST5: Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on
Writing	addressing what is most significant for a specific purpose and audience.
_	9-10WHS16. Use technology, including the internet, to produce, publish, and update individual of shared whiting products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically
	11-12W/HST6: Use technology including the Internet, to produce, publish, and undate 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)

Performance Assessmen	Performance Assessments:	
1 1 Analyze refine and and	nly decision-making skills:	
1 3 Demonstrate oral inter	personal 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, participa	ate, and advocate effectively in pairs, small groups, teams and large groups in order to reach common goals:	
2.6 Use knowledge, build in	nterest, 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	s with repeating behaviors (loops)	
Competencies	Total Learning Hours for Unit: 10	
<ul> <li>Describe how compute</li> </ul>	iters use digital information to represent numbers, words and images	
<ul> <li>Explain why compute</li> </ul>	ers only use digital information	
Explain each parame	eter of the touch sensor configuration panel	
<ul> <li>Program a robot to re</li> </ul>	espond to the touch sensor	
Explain each parame	eter of the ultrasonic sensor configuration panel	
Program a robot to re	espond to the ultrasonic sensor	
Explain each parame	eter of the loop configuration panel	
<ul> <li>Program a robot for r</li> </ul>	epeating behavior controlled by timers, counters and sensors	
<ul> <li>Design, build and pro</li> </ul>	ogram an animatronic robot which resembles and behaves like a selected animal	
-	Aligned Common Core & Washington State Standards	
Art		
	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 cleany and persuasively.	
	northere on grades 11, 12 tenics, texts, and issues, building on othere' ideas and expressions their own clearly and requesively	
	partitiers on grades 11–12 topics, texts, and issues, building on others ideas and expressing their own clearly and persuasively.	
	5-TOSL2. Integrate multiple sources of mormation presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating	
	11-12SI 2: Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to	
	make informed decisions and solve problems, evaluating the credibility and accuracy of each source and poting any discrepancies among	
the data		
Communications 9-10SL4: Present information findings and supporting evidence clearly concisely and logically such that listenars can follow the lin		
	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.	

	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.
Educational Technology	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	
	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.
Math	F-BF1: Write a function that describes a relationship between two quantities.
math	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.
	9-10R14: Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical
Reading	meanings; analyze the cumulative impact of specific word choices on meaning and tone.
	11-12R14: Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical
	meanings; analyze now an author uses and refines the meaning of a key term of terms over the course of a text.
	9-10K17: 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.
	well as in words in order to address a question or solve a problem
	well as in words in order to dudiess a question of solve a problem.
	9-101311. One specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations
	UI descriptions.
	II-IZASI II. UITE 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.
	9-10RS110: By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently
	and proticiently.
	independently and preficiently.
	1100 Periodenity and pronciently.
	9-12313A. Peeuback is a process in which the output of a system provides information used to regulate the operation of the system.
	9-12SVSB: Systems thinking can be especially useful in analyzing complex situations. To be useful, a system needs to be specified as
	dearly as possible
	9-12SVSC: 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
Science	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
	0.11822A: Although energy can be transforred from any object to another and can be transformed from one form of energy to another
	form the total operation a closed system remains the same. The concent of concentration of operative applies to all physical and chemical
	Torm, 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	
	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.
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
	0.120 Will ST10 Write routing hew alguments of minimation.
	and revision) and shorter time frames (a single sitting of 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 Assessment	ts:
Student will design and buil	d a robot that makes decisions based on sensory input
<ul> <li>Leadership Alignment:</li> <li>1.1 Analyze, refine and apply decision-making skills;</li> <li>1.4 Be involved in activities that require applying theory, problem-solving and using critical thinking skills while understanding the outcomes of related decisions;</li> <li>1.6 Conduct self in a professional manner in practical career applications, organizational forums, and decision-making goals;</li> <li>2.1 Communicate, participate, and advocate effectively in pairs, small groups, teams and large groups in order to reach common goals;</li> <li>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</li> </ul>	
	Standards and Competencies
Standard/Unit: Build robots that make bina Plan and develop branching	ry decisions based on sensory input. g programs with switch blocks nested inside loops.
Competencies	Total Learning Hours for Unit: 10
<ul> <li>Explain each parameter of the switch block configuration panel</li> <li>Program a robot to make decisions based on sensory input</li> <li>Explain how a fast switch block nested inside a loop improves detection behavior</li> <li>Build and program a robot to continuously detect objects</li> <li>Build and program a robot to follow a line</li> <li>Create a flow chart to design a hierarchical program</li> </ul>	
• Design, build and pro	Aligned Common Core & Washington State Standards
Art	
Communications	<ul> <li>9-10SL1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on <i>grades</i> 9–10 <i>topics, texts, and issues,</i> building on others' ideas and expressing their own clearly and persuasively.</li> <li>11-12SL1: Initiate and participate effectively in a range of collaborative discussions (one-on- one, in groups, and teacher-led) with diverse partners on <i>grades</i> 11–12 <i>topics, texts, and issues,</i> building on others' ideas and expressing their own clearly and persuasively.</li> <li>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.</li> <li>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.</li> <li>9-10SL4: Present information, findings, and supporting evidence clearly, concisely, and logically 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, such that listeners can follow the line of formation grade of formal and informal tasks.</li> <li>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.</li> <li>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.</li> </ul>

	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
Educational Technology	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	
	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.
Math	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.
	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.
Reading	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.
	9-10RS I 9: 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.
	11-12RS19: Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a concretit understanding of a
	process, phenomenon, or concept, resolving conflicting information when possible.
	9-TORSTTO. By the end of grade TO, read and comprehend science/technical texts in the grades 9-TO text complexity band independently
	and pronciently.
	independently and proficiently
	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
Science	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.
	9-11PSIC: 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 PSTH: Electricity and magnetism are two aspects of a single electromagnetic force. Moving electric charges produce magnetic
	i lorces, and moving magnets produce electric forces.

	<ul> <li>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.</li> <li>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.</li> <li>9-11 PS3E: Electromagnetic waves differ from physical waves because they do not require a medium and they all travel at the same</li> </ul>
	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	<ul> <li>9-12WHST2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.</li> <li>9-12WHST4: Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.</li> <li>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.</li> <li>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.</li> <li>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.</li> <li>9-12WHST10: Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day</li> </ul>
	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

**Total Learning Hours for Unit: 10** 

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

- 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	<ul> <li>9-10SL1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on <i>grades</i> 9–10 <i>topics, texts, and issues,</i> building on others' ideas and expressing their own clearly and persuasively.</li> <li>11-12SL1: Initiate and participate effectively in a range of collaborative discussions (one-on- one, in groups, and teacher-led) with diverse partners on <i>grades</i> 11–12 <i>topics, texts, and issues,</i> building on others' ideas and expressing their own clearly and persuasively.</li> <li>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.</li> <li>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.</li> <li>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.</li> <li>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 style are appropriate to purpose, audience, and task.</li> <li>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.</li> <li>11-12SL5: Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in p</li></ul>
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	
	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
	A CED4: Rearrange formulae to highlight a quantity of interact, using the same reasoning as in solving equations
	E-BE1: Write a function that describes a relationship between two quantities
Math	F-LET: 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.
	9-10RI4: Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical
	Ineanings, analyze the cumulative impact of specific word choices on meaning and tone.
	meanings; analyze how an author uses and refines the meaning of a key term or terms over the course of a text
	9-10 RIZ: 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.
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.
	9-10RST3: 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.
	11-12RS13: 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.
	19-10KS14: 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 guantitative 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
	0.10PST0: Compare and contract findings procented in a text to these from other sources (including their own experiments), noting when
	the follow support or contradict makings presented in a text to those non-other sources (including their own experiments), noting when
	the findings support of contradict previous explanations of accounts.
	11-12KS19: Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a concrete 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.
	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
	9-12INOF: 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
	0.120 DDP: The technological design process begins by defining a problem in terms of criteria and constraints, conducting research, and
	separation several different solutions
	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
Science	means less of another. All solutions involve consequences, some intended, others not.
Science	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 concent of conservation of energy applies to all physical and chemical
	changes
	0.11022D: Woyce (including cound, colomic, light, and water woyce) transfer energy when they interact with matter. Woyce can have
	different wevelengthe frequencies and emplitudes and travel at different encode
	unerent 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

**Total Learning Hours for Unit: 10** 

## 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

- 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	<ul> <li>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.</li> <li>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.</li> <li>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.</li> <li>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.</li> <li>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.</li> <li>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 infor</li></ul>
Educational Technology	<ul><li>1.1.1: Generate ideas and create original works for personal and group expression using a variety of digital tools.</li><li>1.1.2: Use models and simulations to explore systems, identify trends, and forecast possibilities.</li></ul>

	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	<ul> <li>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.</li> <li>N-Q2: Define appropriate quantities for the purpose of descriptive modeling.</li> <li>N-Q3: Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.</li> <li>A-SSE1: Interpret expressions that represent a quantity in terms of its context.</li> <li>A-CED1: Create equations and inequalities in one variable and use them to solve problems.</li> <li>A-CED2: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.</li> <li>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.</li> <li>A-CED4: Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.</li> <li>F-BF1: Write a function that describes a relationship between two quantities.</li> <li>F-LE1: Distinguish between situations that can be modeled with linear functions and with exponential functions.</li> <li>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).</li> <li>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</li> <li>G-MG2: Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).</li> <li>G-MG2: Apply geometric methods to solve design problems (e.g., descripting an object or structure to satisfy physical constraints or minimize cos</li></ul>
	0.10PI4: Determine the meaning of words and phrases as they are used in a text, including figurative, connectative, and technical
	9-10K14. Determine the meaning of words and prilases as they are used in a text, including figurative, connotative, and technical meanings; analyze the cumulative impact of specific word choices on meaning and tope
Reading	<ul> <li>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.</li> <li>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.</li> <li>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.</li> <li>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.</li> <li>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.</li> </ul>
	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.
	9-10KS19. Compare and contrast indings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict provides 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.
	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-ons in which decisions to include more of one quality
Science	0.11PS1A: Average velocity is defined as a change in position with respect to time. Velocity includes both speed and direction
Science	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	
	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.
Writing	9-10WHST6: Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking
Ŭ	advantage of technology's capacity to link to other information and to display information flexibly and dynamically.
	11-12vvn310: Use technology, including the internet, to produce, publish, and update individual or shared writing products in response to
	ongoing recuback, including new arguments or information.
	er two) for a range of discipling energific tasks, purpasse, and audieness
	i or two) for a range of discipline-specific tasks, purposes, and addiences.

## 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 ٠ Program a robot to display variables on the NXT screen ٠ 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 ٠ 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 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 Communications 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.
	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.
Educational Technology	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	
	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).
Math	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 of exponential function in terms of a context.
	G-COT. Know precise deminitions of angle, circle, perpendicular line, paraller line, and line segment, based on the undefined holions of point, line, distance along a line, and distance around a sireular are
	C SPT9: Use trigonometric ratios and the Duthagereen Theorem to solve right triangles in applied problems.
	G-SKT6. Use ingonometric change, their measures, and their properties to describe chiests (e.g., modeling a tree trunk or a human torse as a
	G-MGT. Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk of a numar torso as a cylinder)
	Cyllinder). C MC2: Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per subis feet)
	G-MG2: Apply concepts of density based on area and volume in modeling siduations (e.g., persons per square mile, bit os per cubic toor).
	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 how plots)
	S-ID6: Represent data on two quantitative variables on a scatter plot, mistograms, and box plots).
	S-ID7: Interpret the slope (rate of change) and the intercent (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
	<ul> <li>G-MG2: Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).</li> <li>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).</li> <li>S-ID1: Represent data with plots on the real number line (dot plots, histograms, and box plots).</li> <li>S-ID6: Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.</li> <li>S-ID7: Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.</li> <li>S-ID8: Compute (using technology) and interpret the correlation coefficient of a linear fit.</li> </ul>

	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").
	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.
Reading	11-12RS14: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific
5	scientific or technical context relevant to grades 11–12 texts and topics.
	9-10RS16: 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.
	11-12RS16: Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text,
	0.10PST0: Compare and contract findings presented in a text to these from other sources (including their own experiments), noting when
	be findings support or contrast indings presented in a text to those nom other sources (including their own experiments), noting when
	11 12PST0: Support of contradict previous explanations of accounts.
	records, phonomonon, or concept, resolving conflicting information when possible
	0-10PST10: By the end of grade 10, read and comprehend science/technical texts in the grades 0-10 text complexity hand independently.
	and proficiently
	11-12RST10: By the end of grade 12, read and comprehend science/technical texts in the grades 11–CCR text complexity hand
	independently and proficiently
	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
Science	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.

Writing	11-12WHS16: 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
	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.
	9-12WHST4: Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
	9-12WHST2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.
Social Studies	
	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.
	cnanges. 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.
	9-11PS3A: 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
	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.
	9-11PS1A: 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
	means less of another. All solutions involve consequences, some intended, others not.
	9-12APPE: Perfect solutions do not exist. All technological solutions involve trade-offs in which decisions to include more of one quality

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

	COMPONENTS AND ASSESSMENTS	
Performance Assessmen	Performance Assessments:	
Student will design experim	Student will design experiments and program the NXT to perform scientific data logging of sensor readings	
Leadership Alignment:		
1.1 Analyze, refine and app	oly decision-making skills	
1.3 Demonstrate oral, inter	personal, 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 profes	1.6 Conduct self in a professional manner in practical career applications, organizational forums, and decision-making goals;	
2.1 Communicate, participa	ite, and advocate effectively in pairs, small groups, teams and large groups in order to reach common goals	
2.2 Demonstrate knowledge	e of conflict resolution and challenge management	
2.6 Use knowledge, build in	Iterest, 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 tangit	he and intangible success chiena	
	Standards and Competencies	
Standard/Unit:		
Program the NXT to perform real time data logging with NXT sensors.		
Program the NXT to perform	n remote logging with NXT sensors.	
Program the NXT to perform	n data logging with advanced sensors.	
Analyze logged data with N	IXT-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 NX I 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 NX I-G program		
Design, build and program a robot to perform active data logging with NX I-G		
A	Aligned Common Core & Washington State Standards	
Art		
	9-10SL1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse	
	partiels on grades 9–10 topics, texts, and issues, building on others ideas and expressing their own cleany and persuasively.	
	partners on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.	
	9-10SI 2: Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating	
	the credibility and accuracy of each source	
Communications	11-12SI 2. Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to	
	make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among	
	the data.	
	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.
	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.
Educational Technology	1.3.3: Analyze, synthesize and ethically use information to develop a solution, make informed decisions and report results
Educational Technology	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	
	NO1: Use units as a way to understand problems and to guide the solution of multi-stap problems: shapes and interpret units consistently
	in formulae, phases and interpret the scale and the origin in graphe and date diaplaye
	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.
	A SSE4 Interpret expressions that represent a quantity in terms of its context.
	A-SSET. 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
	A CED4. Because formulae to highlight a questity of interest using the same researing as in aching equations
	A-CED4. Reamange 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-IFT. 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 it is a function and x is an element of its domain, then i(x) denotes the output of i corresponding to the input of the acception of the ac
Math	Input x. The graph of his the graph of the equation $y = i(x)$ .
	r-ir4. For a function that models a relationship between two quantities, interpret key relations of graphs and tables in terms of the guantities, and elected graphs aboving low factures given a verbal description of the relationship.
	quantities, and sketch graphs showing key realures 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 of as a table) over a specified interval.
	Estimate the rate of change from a graph.
	F-IF7: Graph functions expressed symbolically and snow key leatures of the graph, by hand in simple cases and using technology for
	Thore complicated cases.
	F-B-T: white 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").
	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
Reading	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 hand
	independently and proficiently
	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
Science	sufficient detail to make reliable predictions may not be possible
Science	9-12INOA: Scientists generate and evaluate guestions to investigate the natural world
	9-12INOR: 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
	9-12INOC: Conclusions must be logical based on evidence, and consistent with prior established knowledge
	0.12 INOD Communicate Clearly The methods and grass during that accentists use to alterin milling wave the start at a
	9-12 INQU Communicate Clearly The methods and procedures that scientists use to obtain <i>evidence</i> 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	
	0.11. 11. 1. A converse and the second se	
	9-11 LSTA. 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		
	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	
	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	
Writing	0.10//HST6: Use technology including the Internet, to produce publich, and undete individual or charad writing products, taking	
	s-towns to. Use technology, including the internet, to produce, publish, and update individual of shared writing products, taking	
	advantage of technology's capacity to link to other information and to display information nexibly and dynamically.	
	11-12WHS I 6: Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to	
	ongoing feedback, including new arguments or information.	
	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<sup>®</sup> Tech Challenge) COMPONENTS AND ASSESSMENTS

Performance Assessment	ts:	
Student will program Tetrix	robots for competition in the <i>FIRST<sup>®</sup></i> Tech Challenge	
Leadership Alignment:		
1.1 Analyze, refine and app	Iy decision-making skills	
1.3 Demonstrate oral, interp	personal, 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 profes	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	e of conflict resolution and challenge management and involve members of a group to assure that a pro-planned group activity is completed	
8 C 4 Reflect critically on r	nerest, guide, initiatice decisions, organize enorits, and involve members of a group to assure that a pre-planned group activity is completed	
0.0.4 Reflect childany of p	Standards and Competencies	
Standard/Unit:		
Create autonomous Robot(	C programs for Tetrix robots competing in the FIRST® Tech Challenge	
Create RobotC programs for	or Tetrix robots competing in the FIRST® Tech Challenge	
Competencies	Total Learning Hours for Unit: 20	
Demonstrate proficie	ncy with the setup and use of the FTC Samantha module	
Demonstrate proficie	Demonstrate proficiency with the setup and use of the FTC Field Control System	
Demonstrate proficie	ncy with use of the FTC competition software templates	
Demonstrate proficie	ncy 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 proficie	ncy with software management techniques, including revision, backup, quality and reliability controls	
Aligned Common Core & Washington State Standards		
Art		
	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	
Communications	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, indings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of recepting, other extension perspectives are addressed, and the eventiation devidence and the event	
	rollow the line of reasoning, alternative of opposing perspectives are addressed, and the organization, development, substance, and style	
	are appropriate to purpose, audience, and a range of formal and informaticasks.	
	understanding of findings, reasoning, and evidence and to add interest	
	11-12SI 5. 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.	
Art	Aligned Common Core & Washington State Standards         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 at supe of formal and informal tasks.         9-10SL5: Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elem	

	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	
Educational rechnology	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		
	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 $v = f(x)$ .	
	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 guantitative 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.	
Math	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.	
	guadratically, 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 extensions) of the outcomes, or as
	s-CFT. Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as
	COD: Understand that two swarts A and Dare independent if the probability of A and Descurring tagether is the product of their
	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.
	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
	11-12PST1: 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
	makes and to any gaps or inconsistencies in the account.
Reading	11-12RS16: Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text,
5	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
	0-12SVSA: Eeedback is a process in which the output of a system provides information used to regulate the operation of the system
	Positive feedback is a process in which the output of a system provides information used to regulate the operation of the system.
	Control decubation increases the distribution of the approximation of the distribution of the distribution of the second to be approximately a system.
	9-125YSB: Systems thinking can be especially useful in analyzing complex situations. To be useful, a system needs to be specified as
Colonaa	cleany as possible.
Science	9-12515C: 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-THESTC: An object at rest will remain at rest unless acted on by an unbalanced force. An object in motion at constant velocity will sention at the sentences unless the sentences of the senten
	Continue at the same velocity unless acted on by an unbalanced force. (Newton's First Law of Motion, the Law of Inertia)
	19-11 PSTG. Electrical force is a force of nature independent of gravity that exists between charged objects. Opposite charges attract while
	0.11 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: Wayes (including sound seismic light and water wayes) transfer energy when they interact with matter. Wayes 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	
	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
Writing	addressing what is most significant for a specific purpose and audience.
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 15: Hardware Design for Competition (FIRST<sup>®</sup> Tech Challenge)

	COMPONENTS AND ASSESSMENTS	
Performance Assessment	s:	
Student will build Tetrix robe	Student will build Tetrix robots for competition in the FIRST <sup>®</sup> Tech Challenge	
Leadership Alignment:		
1.1 Analyze, refine and app	y decision-making skills	
1.3 Demonstrate oral, interp	ersonal, 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 understand	ing the outcomes of related decisions
1.6 Conduct self in a profes	sional manner in practical career applications, organizational forums, and decision-making goa	als;
2.1 Communicate, participa	e, and advocate effectively in pairs, small groups, teams and large groups in order to reach co	Jininon goals
2.6 Use knowledge build in	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 r	raise, setbacks and criticism	
7.B.2 Understand. negotia	te and balance diverse views and beliefs to reach workable solutions.	
	Standards and Competencies	
Standard/Unit:		
Build Tetrix robot for autono	mous and teleop operations in the <i>FIRST<sup>®</sup></i> Tech Challenge	
Competencies		Total Learning Hours for Unit: 20
Demonstrate proficie	Demonstrate proficiency with the setup and use of the FTC Samantha module	
Demonstrate proficie	<ul> <li>Demonstrate proficiency with the setup and use of the FTC Field Control System</li> </ul>	
Demonstrate proficie	ncy with use of the FTC competition hardware checklist	
<ul> <li>Design, build and tes</li> </ul>	Tetrix robot for FTC autonomous mode scenarios	
<ul> <li>Design, build and test Tetrix robot for FTC teleop mode operations</li> </ul>		
Demonstrate proficiency with competitive hardware management techniques, including risk management, redundancy, fault tolerance, quality/reliability controls		
Aligned Common Core & Washington State Standards		
Art		
	9-10SL1: Initiate and participate effectively in a range of collaborative discussions (one-on-or	ne, in groups, and teacher-led) with diverse
	partners on grades 9–10 topics, texts, and issues, building on others' ideas and expressing tr	neir own clearly and persuasively.
	partners on grades 11–12 topics, texts, and issues, building on others' ideas and expression	their own clearly and persuasively
	9-10SL2: Integrate multiple sources of information presented in diverse media or formats (e.c.	n visually quantitatively orally) evaluating
	the credibility and accuracy of each source	j., visually, quantitatively, orally) evaluating
	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.		5, 1, 5
Communications	9-10SL4: Present information, findings, and supporting evidence clearly, concisely, and logical	ally such that listeners can follow the line of
	reasoning and the organization, development, substance, and style are appropriate to purpos	se, audience, and task.
	11-12SL4: Present information, findings, and supporting evidence, conveying a clear and dist	tinct perspective, such that listeners can
	follow the line of reasoning, alternative or opposing perspectives are addressed, and the orga	anization, development, substance, and style
	are appropriate to purpose, audience, and a range of formal and informal tasks.	
	9-105L5: Make strategic use of digital media (e.g., textual, graphical, audio, visual, and intera	active elements) in presentations to enhance
	understanding of findings, reasoning, and evidence and to add interest.	ractive elements) in presentations to enhance
	understanding of findings, reasoning, and evidence and to add interast	ractive elements) in presentations to enhance
	מוטביזגמוטוווש טר וווטוווש, ובמסטווווש, מוט ביוטבווכב מוט נט מטט ווונבובאו.	

	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	
Educational rechnology	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		
	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 $v = f(x)$ .	
	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.	
Math	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.	
	guadratically, 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.
	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.
	11-12RS11: 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.
Reading	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
Reading	11-12RSTA: 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 tonics
	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 guantitative 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	Independently and proticiently. 9-12SYSA: Feedback is a process in which the output of a system provides information used to regulate the operation of the 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. 9-12INQC: Conclusions must be logical, based on evidence, and consistent with prior established knowledge. 9-12INQC: Conclusions must be logical, based on evidence, and consistent with prior established knowledge. 9-12INQC: Conclusions must be logical, based on evidence, and consistent with prior established knowledge. 9-12INQC: Conclusions must be logical, based on evidence, and consistent with prior established knowledge. 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 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: Attoma are composed of protons, neutron
Social Studies	
	9-12WHST2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or
Writing	<ul> <li>technical processes.</li> <li>9-12WHST4: Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.</li> <li>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.</li> <li>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.</li> <li>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.</li> <li>9-12WHST10: Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or the planet).</li> </ul>

21 <sup>st</sup> Century Skills			
Check those that students will demonstrate in this course:			
LEARNING & INNOVATION	INFORMATION, MEDIA & TECHNOLOGY SKILLS	LIFE & CAREER SKILLS	
Creativity and Innovation            ○ Think Creatively             ○ Work Creatively with Others             ○ Implement Innovations          Critical Thinking and Problem Solving            ○ Reason Effectively             ○ Use Systems Thinking             ○ Make Judgments and Decisions             ○ Solve Problems             Communication and Collaboration             ○ Collaborate with Others	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	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	

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