

AFRL NM STEM Academy

Middle School Standards Alignment for the Robotics Challenge Mission

Mod 1: Intro Programming
 Mod 2: Using the Microbit
 Mod 3: Build/Control Robot
 Mod 4: Expo Readiness
 Robotic Expo

Common Core Standards for English Language Arts (Grades 6-8)

Reading Standards for Informational Text

Craft and Structure							
Grade 6	4.	Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings.	X	X	X	X	X
Grade 7	4.	Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the impact of a specific word choice on meaning and tone.	X	X	X	X	X
Grade 8	4.	Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the impact of specific word choices on meaning and tone, including analogies or allusions to other texts.	X	X	X	X	X
Integration of Knowledge and Ideas							
Grade 6	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.	X	X	X	X	
Range of Reading and Level of Text Complexity							
Grade 6	10.	By the end of the year, read and comprehend literary nonfiction in the grades 6-8 text complexity band proficiently, with scaffolding as needed at the high end of the range.	X	X	X	X	X
Grade 7	10.	By the end of the year, read and comprehend literary nonfiction in the grades 6-8 text complexity band proficiently, with scaffolding as needed at the high end of the range.	X	X	X	X	X
Grade 8	10.	By the end of the year, read and comprehend literary nonfiction at the high end of the grades 6-8 text complexity band independently and proficiently.	X	X	X	X	X

Writing Standards

Research to Build and Present Knowledge							
Grade 6	7.	Conduct short research projects to answer a question, drawing on several sources and refocusing the inquiry when appropriate.	X	X	X	X	X
Grade 7	7.	Conduct short research projects to answer a question, drawing on several sources and generating additional related, focused questions for further research and investigation.	X	X	X	X	X
Grade 8	7.	Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.	X	X	X	X	X

Speaking and Listening Standards

Comprehension and Collaboration							
Grade 6	1.	Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-lead) with diverse partners on <i>grade 6 topics and texts</i> , building on others' ideas and expressing their own clearly.	X	X	X	X	X
		a. Come to discussions prepared, having read or studied required material; explicitly draw on that preparation by referring to evidence on the topic, text, or issues to probe and reflect on ideas under discussion.	X	X	X	X	X
		b. Follow rules for collegial discussions, set specific goals and deadlines, and define individual roles as needed.	X	X	X	X	X
		c. Pose and respond to specific questions with elaboration and detail by making comments that contribute to the topic, text, or issue under discussion.	X	X	X	X	X
	2.	Interpret information presented in diverse media and formats (e.g., visually, quantitatively, orally) and explain how it contributes to a topic, text, or issue under study.	X	X	X	X	X
	3.	Delineate a speaker's argument and specific claims, distinguishing claims that are supported by reasons and evidence from claims that are not.	X	X	X	X	X
Grade 7	1.	Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-lead) with diverse partners on <i>grade 7 topics, texts, and issues</i> , building on others' ideas and expressing their own clearly.	X	X	X	X	X
		a. Come to discussions prepared, having read or researched material under study; explicitly draw on that preparation by referring to evidence on the topic, text, or issue to probe and reflect on ideas under discussion.	X	X	X	X	X
		b. Follow rules for collegial discussions, track progress toward specific goals and deadlines, and define individual roles as needed.	X	X	X	X	X
		c. Pose questions that elicit elaboration and respond to others' questions and comments with relevant observations and ideas that bring the discussion back on topic as needed.	X	X	X	X	X
		d. Acknowledge new information expressed by others and, when warranted, modify their own views.	X	X	X	X	X
	2.	Analyze the main ideas and supporting details presented in diverse media and formats (e.g., visually, quantitatively, orally) and explain how the ideas clarify a topic, text, or issue under study.	X	X	X	X	X
	3.	Delineate a speaker's argument and specific claims, evaluating the soundness of the reasoning and the relevance and sufficiency of the evidence.	X	X	X	X	X
Grade 8	1.	Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-lead) with diverse partners on <i>grade 8 topics, texts, and issues</i> , building on others' ideas and expressing their own clearly.	X	X	X	X	X
		a. Come to discussions prepared, having read or researched material under study; explicitly draw on that preparation by referring to evidence on the topic, text, or issue to probe and reflect on ideas under discussion.	X	X	X	X	X
		b. Follow rules for collegial discussions and decision-making, track progress toward specific goals and deadlines, and define individual roles as needed.	X	X	X	X	X
		c. Pose questions that connect the ideas of several speakers and respond to others' questions and comments with relevant observations and ideas.	X	X	X	X	X
		d. Acknowledge new information expressed by others and, when warranted, qualify or justify their own views in light of the evidence presented.	X	X	X	X	X
	2.	Analyze the purpose of information presented in diverse media and formats (e.g., visually, quantitatively, orally) and evaluate the motives (e.g., social, commercial, political) behind its presentation.	X	X	X	X	X
	3.	Delineate a speaker's argument and specific claims, evaluating the soundness of the reasoning and the relevance and sufficiency of the evidence and identifying when irrelevant evidence is introduced.	X	X	X	X	X

Language Standards

Conventions of Standard English							
Grade 6	2.	Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.	X	X	X	X	X
		b. Spell correctly.	X	X	X	X	X
Grade 7	2.	Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.	X	X	X	X	X
		b. Spell correctly.	X	X	X	X	X
Grade 8	2.	Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.	X	X	X	X	X
		c. Spell correctly.	X	X	X	X	X
Vocabulary Acquisition and Use							
Grade 6	4.	Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on <i>grade 6 reading and content</i> , choosing flexibly from a range of strategies.	X	X	X	X	X
		a. Use context (e.g., the overall meaning of a sentence or paragraph; a word's position or function in a sentence) as a clue to the meaning of a word or phrase.	X	X	X	X	X
	6.	Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases; gather vocabulary knowledge when considering a word or phrase important to comprehension or expression.	X	X	X	X	X

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Grade 7	4.	Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on <i>grade 7 reading and content</i> , choosing flexibly from a range of strategies.	X	X	X	X	X
		a. Use context (e.g., the overall meaning of a sentence or paragraph; a word's position or function in a sentence) as a clue to the meaning of a word or phrase.	X	X	X	X	X
	6.	Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases; gather vocabulary knowledge when considering a word or phrase important to comprehension or expression.	X	X	X	X	X
Grade 8	4.	Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on <i>grade 8 reading and content</i> , choosing flexibly from a range of strategies.	X	X	X	X	X
		a. Use context (e.g., the overall meaning of a sentence or paragraph; a word's position or function in a sentence) as a clue to the meaning of a word or phrase.	X	X	X	X	X
	6.	Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases; gather vocabulary knowledge when considering a word or phrase important to comprehension or expression.	X	X	X	X	X

Reading Standards for Literacy in Science and Technical Subjects							
Key Ideas and Details							
Grades 6-8	3.	Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.	X	X	X	X	X
	Craft and Structure						
Grades 6-8	4.	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 <i>grades 6-8 texts and topics</i> .	X	X	X	X	X
	Integration of Knowledge and Ideas						
Grades 6-8	7.	Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).	X	X	X	X	X
	Range of Reading and Level of Text Complexity						
Grades 6-8	10.	By the end of grade 8, read and comprehend science/technical texts in the grades 6-8 text complexity band independently and proficiently.	X	X	X	X	X

Common Core Standards for Mathematics (Grades 6-8)

Mathematical Practices							
1.	Make sense of problems and persevere in solving them.		X	X	X	X	X
	2.	Reason abstractly and quantitatively.		X	X	X	X
4.		Model with mathematics.		X	X	X	X
	5.	Use appropriate tools strategically.		X	X	X	X
6.		Attend to precision.		X	X	X	X
	7.	Look for and make use of structure.		X	X	X	X
8.		Look for and express regularity in repeated reasoning.		X	X	X	X

Ratios and Proportional Relationships

Grade 6	•	Understand ratio concepts and use ratio reasoning to solve problems					
	3.	Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.	X		X	X	X
		a. Make tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios. b. Solve unit rate problems including those involving unit pricing and constant speed. <i>For example, if it took 7 hours to mow 4 lawns, then at that rate, how many lawns could be mowed in 35 hours? At what rate were lawns being mowed?</i>			X		X
Grade 7	•	Analyze proportional relationships and use them to solve real-world and mathematical problems.					
	1.	Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. <i>For example, if a person walks 1/2 mile in each 1/4 hour, compute the unit rate as the complex fraction 1/2 / 1/4 miles per hour, equivalently 2 miles per hour.</i>	X		X	X	X
	2.	Recognize and represent proportional relationships between quantities.	X		X	X	X
	3.	Use proportional relationships to solve multistep ratio and percent problems. <i>Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.</i>	X		X	X	X

The Number System

Grade 6	•	Apply and extend previous understandings of numbers to the system of rational numbers.					
	5.	Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation.			X	X	X
Grade 7	•	Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.					
	1.	Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram.	X		X	X	X
		d. Apply properties of operations as strategies to add and subtract rational numbers.	X		X	X	X
	2.	Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.	X		X	X	X
		c. Apply properties of operations as strategies to multiply and divide rational numbers.	X		X	X	X
Grade 8	•	Analyze and solve linear equations and pairs of simultaneous linear equations.					
	7.	Solve linear equations in one variable.	X				
		b. Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.	X				

Expressions and Equations

Grade 6	•	Apply and extend previous understandings of arithmetic to algebraic expressions.					
	1.	Write and evaluate numerical expressions involving whole-number exponents.	X				
	2.	Write, read, and evaluate expressions in which letters stand for numbers.	X			X	X
		a. Write expressions that record operations with numbers and with letters standing for numbers. <i>For example, express the calculation "Subtract y from 5" as 5 - y.</i>	X			X	X
Grade 6	•	Reason about and solve one-variable equations and inequalities.					
	5.	Understand solving an equation or inequality as a process of answering a question: which values from a specified set, if any, make the equation or inequality true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true.	X	X	X	X	X
	6.	Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.	X	X	X	X	X
	7.	Solve real-world and mathematical problems by writing and solving equations of the form $x + p = q$ and $px = q$ for cases in which p, q, x and px are all nonnegative rational numbers.	X				

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Grade 7	<ul style="list-style-type: none"> Use properties of operations to generate equivalent expressions. 					
	1. Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.	X				
Grade 7	<ul style="list-style-type: none"> Solve real-life and mathematical problems using numerical and algebraic expressions and equations. 					
	3. Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. <i>For example: If a woman making \$25 an hour gets a 10% raise, she will make an additional 1/10 of her salary an hour, or \$2.50, for a new salary of \$27.50. If you want to place a towel bar 9 3/4 inches long in the center of a door that is 27 1/2 inches wide, you will need to place the bar about 9 inches from each edge; this estimate can be used as a check on the exact computation.</i>	X		X	X	X
	4. Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.	X	X	X	X	X
	a. Solve word problems leading to equations of the form $px + q = r$ and $p(x + q) = r$, where p , q , and r are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. <i>For example, the perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width?</i>	X				

Geometry						
Grade 7	<ul style="list-style-type: none"> Draw construct, and describe geometrical figures and describe the relationships between them. 					
	1. Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.	X		X		
	2. Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions. Focus on constructing triangles from three measures of angles or sides, noticing when conditions determine a unique triangle, more than one triangle, or no triangle.	X		X		
Grade 7	<ul style="list-style-type: none"> Solve real-life and mathematical problems involving angle measure, area, surface area, and volume. 					
	4. Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle.	X				
	5. Use facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and solve simple equations for an unknown angle in a figure.	X		X		
Grade 8	<ul style="list-style-type: none"> Understand congruence and similarity using physical models, transparencies, or geometry software. 					
	1. Verify experimentally the properties of rotations, reflections, and translations:	X		X	X	X
	a. Lines are taken to lines, and line segments to line segments of the same length.	X		X	X	X
	b. Angles are taken to angles of the same measure.	X		X	X	X
	2. Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.	X				

Next Generation Science Standards (Grades 6-8)

Performance Expectations

Engineering Design

MS-ETS1	Engineering Design					
	3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.	X	X	X	X	X
	4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.	X	X	X	X	X
Disciplinary Core Ideas						
ETS1.B: Developing Possible Solutions						
	• A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. (MS-ETS1-4)	X	X	X	X	X
	• There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (MS-ETS1-2), (MS-ETS1-3)	X	X	X	X	X
	• Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. (MS-ETS1-3)	X	X	X	X	X
	• Models of all kinds are important for testing solutions. (MS-ETS1-4)	X	X	X	X	X
ETS1.C: Optimizing the Design Solution						
	• Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process—that is, some of those characteristics may be incorporated into the new design. (MS-ETS1-3)	X	X	X	X	X
	• The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution. (MSETS1-4)	X	X	X	X	X

Science and Engineering Practices

Engaging in scientific investigation requires not only skill but also knowledge that is specific to each practice.

	2. Developing and using models	X	X	X	X	X
	3. Planning and carrying out investigations	X	X	X	X	X
	4. Analyzing and interpreting data	X	X	X	X	X
	5. Using mathematics and computational thinking	X	X	X	X	X
	6. Constructing explanations (for science) and designing solutions (for engineering)	X	X	X	X	X
	8. Obtaining, evaluating, and communicating information	X	X	X	X	X

Cross Cutting Concepts

Patterns: Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them.

	• Patterns in rates of change and other numerical relationships can provide information about natural and human designed systems.	X	X	X	X	X
	• Patterns can be used to identify cause and effect relationships.	X	X	X	X	X
	• Graphs, charts, and images can be used to identify patterns in data.	X	X	X	X	X

Cause and Effect: Mechanism and Prediction: Events have causes, sometimes simple, sometimes multifaceted. Deciphering causal relationships, and the mechanisms by which they are mediated, is a major activity of science and engineering.

	• Cause and effect relationships may be used to predict phenomena in natural or designed systems.	X	X	X	X	X
	• Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability.	X	X	X	X	X

Scale, Proportion, and Quantity: In considering phenomena, it is critical to recognize what is relevant at different size, time, and energy scales, and to recognize proportional relationships between different quantities as scales change.

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♦ The observed function of natural and designed systems may change with scale.	X		X			
♦ Proportional relationships (e.g., speed as the ratio of distance traveled to time taken) among different types of quantities provide information about the magnitude of properties and processes.	X		X			
Systems and System Models: A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems.						
♦ Systems may interact with other systems; they may have sub-systems and be a part of larger complex systems.	X	X	X	X	X	X
♦ Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy, matter, and information flows within systems.	X	X	X	X	X	X
Energy and Matter: Flows, Cycles, and Conservation: Tracking energy and matter flows, into, out of, and within systems helps one understand their system's behavior.						
♦ The transfer of energy can be tracked as energy flows through a designed or natural system.	X	X	X	X	X	X
Stability and Change: For both designed and natural systems, conditions that affect stability and factors that control rates of change are critical elements to consider and understand.						
♦ Small changes in one part of a system might cause large changes in another part.	X	X	X	X	X	X

Computer Science Standards (Grades 6-8)

Computing Systems						
2-CS-02	Design projects that combine hardware and software components to collect and exchange data.	X	X	X	X	X
2-CS-03	Systematically identify and fix problems with computing devices and their components.	X	X	X	X	X
Data and Analysis						
2-DA-07	Represent data using multiple encoding schemes.	X	X	X	X	X
2-DA-08	Collect data using computational tools and transform the data to make it more useful and reliable.	X	X	X	X	X
2-DA-09	Refine computational models based on the data they have generated.	X	X	X	X	X
Algorithms and Programming						
2-AP-10	Use flowcharts and/or pseudocode to address complex problems as algorithms.	X	X	X	X	X
2-AP-11	Create clearly named variables that represent different data types and perform operations on their values.	X	X	X	X	X
2-AP-12	Design and iteratively develop programs that combine control structures, including nested loops and compound conditionals.	X	X	X	X	X
2-AP-13	Decompose problems and subproblems into parts to facilitate the design, implementation, and review of programs.	X	X	X	X	X
2-AP-14	Create procedures with parameters to organize code and make it easier to reuse.	X	X	X	X	X
2-AP-15	Seek and incorporate feedback from team members and users to refine a solution that meets user needs.	X	X	X	X	X
2-AP-16	Incorporate existing code, media, and libraries into original programs, and give attribution.	X	X	X	X	X
2-AP-17	Systematically test and refine programs using a range of test cases.	X	X	X	X	X
2-AP-18	Distribute tasks and maintain a project timeline when collaboratively developing computational artifacts.	X	X	X	X	X
2-AP-19	Document programs in order to make them easier to follow, test, and debug.	X	X	X	X	X

International Society for Technology Education Standards

Empowered Learner						
♦	Students leverage technology to take an active role in choosing, achieving and demonstrating competency in their learning goals, informed by the learning sciences.					
1c	Students use technology to seek feedback that informs and improves their practice and to demonstrate their learning in a variety of ways.	X	X	X	X	X
1d	Students understand the fundamental concepts of technology operations, demonstrate the ability to choose, use and troubleshoot current technologies and are able to transfer their knowledge to explore emerging technologies.	X	X	X	X	X
Digital Citizen						
♦	Students recognize the rights, responsibilities and opportunities of living, learning and working in an interconnected digital world, and they act and model in ways that are safe, legal and ethical.					
2a	Students cultivate and manage their digital identity and reputation and are aware of the permanence of their actions in the digital world.	X	X	X	X	X
2b	Students engage in positive, safe, legal and ethical behavior when using technology, including social interactions online or when using networked devices.	X	X	X	X	X
Innovative Designer						
♦	Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources					
4a	Students know and use a deliberate design process for generating ideas, testing theories, creating innovative artifacts or solving authentic problems.	X	X	X	X	X
4b	Students select and use digital tools to plan and manage a design process that considers design constraints and calculated risks.	X	X	X	X	X
4c	Students develop, test and refine prototypes as part of a cyclical design process.	X	X	X	X	X
4d	Students exhibit a tolerance for ambiguity, perseverance and the capacity to work with open-ended problems.	X	X	X	X	X
Computational Thinker						
♦	Students develop and employ strategies for understanding and solving problems in ways that leverage the power of technological methods to develop and test solutions.					
5d	Students understand how automation works and use algorithmic thinking to develop a sequence of steps to create and test automated solutions.	X	X	X	X	X
Global Collaborator						
♦	Students use digital tools to broaden their perspectives and enrich their learning by collaborating with others and working effectively in teams locally and globally.					
7c	Students contribute constructively to project teams, assuming various roles and responsibilities to work effectively toward a common goal.	X	X	X	X	X