

**FIRST® Tech Challenge 21<sup>st</sup> Century Learning Skills Alignment & Instructional Exemplars**

**Rationale**

There is no evidence that the standard is addressed as part of a *FIRST®* program.

This standard potentially could be addressed as part of a *FIRST®* program either by actions that the coach/mentor takes when working with the students or by conditions established by the program for that given year.

The standard is clearly addressed by program activities.

**Color Code**



**Student Outcomes**

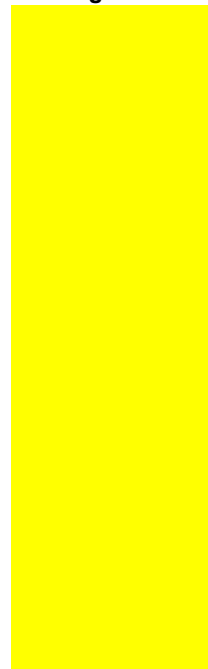
**FIRST® Alignment**

**Instructional Exemplar**

Core Subjects  
 English, reading or language arts  
 World languages  
 Arts  
 Mathematics  
 Economics  
 Science  
 Geography  
 History  
 Government and Civics

Global Awareness

Using 21st century skills to understand and address global issues



Depending on the extension activities that the *FIRST® Tech Challenge* team participates in, team members may have the opportunity to research, understand, and develop potential solutions to global issues.

Core Subjects  
 English, reading or language arts  
 World languages  
 Arts  
 Mathematics  
 Economics  
 Science  
 Geography  
 History  
 Government and Civics

Global Awareness

Learning from and working collaboratively with individuals representing diverse cultures, religions and lifestyles in a spirit of mutual respect and open dialogue in personal, work and community contexts

Depending upon the composition of the *FIRST® Tech Challenge* team and the regions in which they compete, students may have the opportunity to learn and work with students from different cultures. Collaboration through scouting and competing may increase the degree to which students possess the attitudes and beliefs for living in a world where national cultures are converging and civilization is becoming more global.

Core Subjects  
English, reading or language arts  
World languages  
Arts  
Mathematics  
Economics  
Science  
Geography  
History  
Government and Civics

Global Awareness

Understanding other nations and cultures, including the use of non-English languages

Depending upon the composition of the *FIRST®* Tech Challenge team and the regions in which they compete, students may have the opportunity to learn and work with students from different cultures. Collaboration through scouting and competing may increase the degree to which students possess the attitudes and beliefs for living in a world where national cultures are converging and civilization is becoming more global.

Core Subjects  
English, reading or language arts  
World languages  
Arts  
Mathematics  
Economics  
Science  
Geography  
History  
Government and Civics

Financial, economic, business and entrepreneurial literacy

Knowing how to make appropriate personal economic choices

As part of the *FIRST®* Tech Challenge students may work with money as they have to budget for robot parts, tools, and other materials to participate in the competition.

Core Subjects  
English, reading or language arts  
World languages  
Arts  
Mathematics  
Economics  
Science  
Geography  
History  
Government and Civics

Financial, economic, business and entrepreneurial literacy

Understanding the role of the economy in society

As part of the *FIRST®* Tech Challenge students may work with money as they have to budget for robot parts, tools, and other materials to participate in the competition which allows them to develop an understanding of how the economy works.

Core Subjects  
English, reading or language arts  
World languages  
Arts  
Mathematics  
Economics  
Science  
Geography  
History  
Government and Civics

Financial, economic, business and entrepreneurial literacy

Using entrepreneurial skills to enhance workplace productivity and career options

As part of the *FIRST®* Tech Challenge students may use their entrepreneurial skills to fundraise to support the purchase of robot parts, tools, and other materials to participate in the competition.

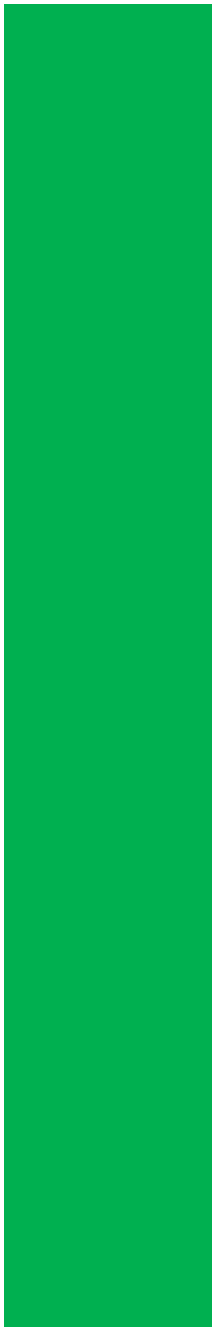
Core Subjects	<p>English, reading or language arts World languages Arts Mathematics Economics Science Geography History Government and Civics</p>	Civic literacy	Participating effectively in civic life through knowing how to stay informed and understanding governmental processes	Depending upon how the coach/mentor chooses to interact with local government and civic agencies (e.g., Chamber of Commerce) <i>FIRST</i> ® Tech Challenge students may learn about and participate in governmental processes.
Core Subjects	<p>English, reading or language arts World languages Arts Mathematics Economics Science Geography History Government and Civics</p>	Civic literacy	Exercising the rights and obligations of citizenship at local, state, national and global levels	Depending upon how the coach/mentor chooses to interact with local government and civic agencies (e.g., Chamber of Commerce) <i>FIRST</i> ® Tech Challenge students may exercise their rights as they apply for grants or request funding from governmental agencies.
Core Subjects	<p>English, reading or language arts World languages Arts Mathematics Economics Science Geography History Government and Civics</p>	Civic literacy	Understanding the local and global implications of civic decisions	Not Applicable
Core Subjects	<p>English, reading or language arts World languages Arts Mathematics Economics Science Geography History Government and Civics</p>	Health literacy	Obtaining, interpreting and understanding basic health information and services and using such information and services in ways that are health enhancing	Not Applicable

Core Subjects	English, reading or language arts World languages Arts Mathematics Economics Science Geography History Government and Civics	Health literacy	Understanding preventive physical and mental health measures, including proper diet, nutrition, exercise, risk avoidance and stress reduction	Not Applicable
Core Subjects	English, reading or language arts World languages Arts Mathematics Economics Science Geography History Government and Civics	Health literacy	Using available information to make appropriate health-related decisions	Not Applicable
Core Subjects	English, reading or language arts World languages Arts Mathematics Economics Science Geography History Government and Civics	Health literacy	Establishing and monitoring personal and family health goals	Not Applicable
Core Subjects	English, reading or language arts World languages Arts Mathematics Economics Science Geography History Government and Civics	Health literacy	Understanding national and international public health and safety issues	Not Applicable



Core Subjects	English, reading or language arts World languages Arts Mathematics Economics Science Geography History Government and Civics	Environmental literacy	Demonstrate knowledge and understanding of the environment and the circumstances and conditions affecting it, particularly as relates to air, climate, land, food, energy, water and ecosystems	Depending on the extension activities that the <i>FIRST</i> ® Tech Challenge team participates in, team members may have the opportunity to research, understand, and develop potential solutions to environmental issues.
Core Subjects	English, reading or language arts World languages Arts Mathematics Economics Science Geography History Government and Civics	Environmental literacy	Demonstrate knowledge and understanding of society's impact on the natural world (e.g., population growth, population development, resource consumption rate, etc.)	Depending on the extension activities that the <i>FIRST</i> ® Tech Challenge team participates in, team members may have the opportunity to research, understand, and develop potential solutions to societal impact on the natural world.
Core Subjects	English, reading or language arts World languages Arts Mathematics Economics Science Geography History Government and Civics	Environmental literacy	Investigate and analyze environmental issues, and make accurate conclusions about effective solutions	Depending on the extension activities that the <i>FIRST</i> ® Tech Challenge team participates in, team members may have the opportunity to research, understand, and develop potential solutions to environmental issues.
Core Subjects	English, reading or language arts World languages Arts Mathematics Economics Science Geography History Government and Civics	Environmental literacy	Take individual and collective action towards addressing environmental challenges (e.g., participating in global actions, designing solutions that inspire action on environmental issues)	Depending on the extension activities that the <i>FIRST</i> ® Tech Challenge team participates in, team members may have the opportunity to research, understand, and develop potential solutions to environmental issues.
Learning and Innovation Skills	Creativity and Innovation	Think Creatively	Use a wide range of idea creation techniques (such as brainstorming)	Students use brainstorming to generate robot design, game strategy, and fundraising ideas as they work to successfully build and program their robot and compete

Learning and Innovation Skills	Creativity and Innovation	Think Creatively	Create new and worthwhile ideas (both incremental and radical concepts)
Learning and Innovation Skills	Creativity and Innovation	Think Creatively	Elaborate, refine, analyze and evaluate their own ideas in order to improve and maximize creative efforts
Learning and Innovation Skills	Creativity and Innovation	Work Creatively with Others	Develop, implement and communicate new ideas to others effectively
Learning and Innovation Skills	Creativity and Innovation	Work Creatively with Others	Be open and responsive to new and diverse perspectives; incorporate group input and feedback into the work
Learning and Innovation Skills	Creativity and Innovation	Work Creatively with Others	Demonstrate originality and inventiveness in work and understand the real world limits to adopting new ideas
Learning and Innovation Skills	Creativity and Innovation	Work Creatively with Others	View failure as an opportunity to learn; understand that creativity and innovation is a long-term, cyclical process of small successes and frequent mistakes
Learning and Innovation Skills	Creativity and Innovation	Implement Innovations	Act on creative ideas to make a tangible and useful contribution to the field in which the innovation will occur
Learning and Innovation Skills	Critical Thinking and Problem Solving	Reason Effectively	Use various types of reasoning (inductive, deductive, etc.) as appropriate to the situation
Learning and Innovation Skills	Critical Thinking and Problem Solving	Use Systems Thinking	Analyze how parts of a whole interact with each other to produce overall outcomes in complex systems
Learning and Innovation Skills	Critical Thinking and Problem Solving	Make Judgments and Decisions	Effectively analyze and evaluate evidence, arguments, claims and beliefs



In building their robot, *FIRST®* Tech Challenge students create new ideas to address the game challenge and problems they encounter as part of designing, building, programming, and operating a robot.

Students engage in a process of elaboration and refinement to settle on the most optimal design and game strategy.

Students must communicate ideas effectively with team members to address real-world problems they encounter as well as share the team's solution with others.

Students must be open to all individual ideas and work together to develop an agreed upon solution for the design of the robot and the game strategy.

Students develop an innovative solution to a challenge of designing, building, and programming a robot to compete successfully within the parameters of the competition.

In building their robot, *FIRST®* Tech Challenge students constantly refine their solutions and learn from mistakes.

Students create an innovative solutions to real-world problems they encounter as they design, build, program, and operate their robot and develop their game strategy.

Students use all types of reasoning to develop and refine the innovative solutions they develop to problems they encounter during the competition.

As students design their robot they have to consider how all parts of the robot will work together, how all team members will work together, and how their team will interact with other teams to produce the desired outcome

As students design, build, program, and operate their robot, they will have to analyze and evaluate evidence as they make their decisions.

Learning and Innovation Skills	Critical Thinking and Problem Solving	Make Judgments and Decisions	Analyze and evaluate major alternative points of view		As a <i>FIRST</i> ® Tech Challenge team is made up of several individuals, students will need to analyze and evaluate alternative points of view as they settle on a final solutions for robot design, construction, programming, and operation.
Learning and Innovation Skills	Critical Thinking and Problem Solving	Make Judgments and Decisions	Synthesize and make connections between information and arguments		Students will research information and synthesize information to create innovative solutions to the real-world problems they encounter as they design, build, program, and operate their robot.
Learning and Innovation Skills	Critical Thinking and Problem Solving	Make Judgments and Decisions	Interpret information and draw conclusions based on the best analysis		In designing their robot, students will interpret information and determine how best to use it to create an innovative robot and game strategy.
Learning and Innovation Skills	Critical Thinking and Problem Solving	Make Judgments and Decisions	Reflect critically on learning experiences and processes		As part of continual improvement, students will reflect on their ideas and approaches to designing their robot and game strategy to refine their processes.
Learning and Innovation Skills	Critical Thinking and Problem Solving	Solve Problems	Solve different kinds of non-familiar problems in both conventional and innovative ways		As part of the competition, students will be expected to solve many types of non-familiar problems as they design, build, and program their robot and develop their game strategy.
Learning and Innovation Skills	Critical Thinking and Problem Solving	Solve Problems	Identify and ask significant questions that clarify various points of view and lead to better solutions		Students will need to ask questions of each other, their coach/mentor, and subject-matter experts to develop their solution.
Learning and Innovation Skills	Communication and Collaboration	Communicate Clearly	Articulate thoughts and ideas effectively using oral, written and nonverbal communication skills in a variety of forms and contexts		Students will have to communicate effectively with each other as well as others to design, build, and program their robot, develop their game strategy, to raise funds and to apply and compete for awards.
Learning and Innovation Skills	Communication and Collaboration	Communicate Clearly	Listen effectively to decipher meaning, including knowledge, values, attitudes and intentions		Students will have to listen effectively to each other to complete tasks and a develop collective solution.
Learning and Innovation Skills	Communication and Collaboration	Communicate Clearly	Use communication for a range of purposes (e.g. to inform, instruct, motivate and persuade)		Students will communicate for a wide range of purposes as they talk to their peers, visitors to the pits, sponsors and award judges.
Learning and Innovation Skills	Communication and Collaboration	Communicate Clearly	Utilize multiple media and technologies, and know how to judge their effectiveness a priori as well as assess their impact		Depending upon how students decide to present in their pits or during fundraising activities, they may use multiple media and technologies. If a team chooses to apply for a Connect or Promote award or participate in a League Meet, a video submission is required.

Learning and Innovation Skills	Communication and Collaboration	Communicate Clearly	Communicate effectively in diverse environments (including multi-lingual)		Depending upon the make up of the team and their community and the type of outreach the team chooses to conduct, students may work with students in diverse environments. Teams may also build relationships with international teams through mentoring activities.
Learning and Innovation Skills	Communication and Collaboration	Collaborate with Others	Demonstrate ability to work effectively and respectfully with diverse teams		Students will work with individuals on their team to design, build, program and operate the robot and develop a game strategy. Many teams also work with other domestic and international teams. In addition, teams must evaluate other teams performance to form alliances and work together to obtain points on the competition field.
Learning and Innovation Skills	Communication and Collaboration	Collaborate with Others	Exercise flexibility and willingness to be helpful in making necessary compromises to accomplish a common goal		Students will work with individuals on their team to develop the best innovative solution as they design, build, program and operate the robot and develop a game strategy.
Learning and Innovation Skills	Communication and Collaboration	Collaborate with Others	Assume shared responsibility for collaborative work, and value the individual contributions made by each team member		Students work collaboratively to complete tasks and develop a team solution to the Challenge.
Information, Media and Technology Skills	Information Literacy	Access and Evaluate Information	Access information efficiently (time) and effectively (sources)		Students must determine the types of information they need to complete design, build and program their robot, community outreach, and fundraising.
Information, Media and Technology Skills	Information Literacy	Access and Evaluate Information	Evaluate information critically and competently		Students must evaluate information about designing, building, and programming the robot for the optimal performance on the playing field. They will also evaluate information from test runs of the robot to refine performance.
Information, Media and Technology Skills	Information Literacy	Use and Manage Information	Use information accurately and creatively for the issue or problem at hand		Students will use information gained through research to develop an innovative solution to real-world problems the encounter during the competition.
Information, Media and Technology Skills	Information Literacy	Use and Manage Information	Manage the flow of information from a wide variety of sources		Students will have to evaluate information from multiple sources to make decisions and address problems that arise as they design, build, program, and operate their robot.
Information, Media and Technology Skills	Information Literacy	Use and Manage Information	Apply a fundamental understanding of the ethical/legal issues surrounding the access and use of information		When creating videos for the Promote and Compass Awards, teams are instructed to use only public access music and/or to give credit where due.



Information, Media and Technology Skills	Media Literacy	Analyze Media	Understand both how and why media messages are constructed, and for what purposes		If a team chooses to create a Compass or Promote video or has to create a League Meet video, they may take time to discuss making a media message and the intent and overall impact of the choices made.
Information, Media and Technology Skills	Media Literacy	Analyze Media	Examine how individuals interpret messages differently, how values and points of view are included or excluded, and how media can influence beliefs and behaviors		If a team chooses to create a Compass or Promote video or has to create a League Meet video, they may take time to discuss making a media message and the intent and overall impact of the choices made.
Information, Media and Technology Skills	Media Literacy	Analyze Media	Apply a fundamental understanding of the ethical/legal issues surrounding the access and use of media		If a team chooses to create a Compass or Promote video or has to create a League Meet video, they may take time to discuss making a media message and the intent and overall impact of the choices made.
Information, Media and Technology Skills	Media Literacy	Create Media Products	Understand and utilize the most appropriate media creation tools, characteristics and conventions		Depending on the presentation choices, the type of awards teams choose to apply for, and whether a team has the opportunity to attend a League Meet, students will use a variety of media creation tools.
Information, Media and Technology Skills	Media Literacy	Create Media Products	Understand and effectively utilize the most appropriate expressions and interpretations in diverse, multi-cultural environments		Depending upon the make-up of the team and location of the competition, students may present in diverse, multicultural environments. Many teams also work with other domestic and international teams. In addition, teams compete in randomly-selected alliances and must work with this partner to obtain points on the competition field.
Information, Media and Technology Skills	ICT Literacy	Apply Technology Effectively	Use technology as a tool to research, organize, evaluate and communicate information		Throughout the program, students will use technology as a tool to design, build, program, and operate their robot as well as to communicate with other teams or present information.
Information, Media and Technology Skills	ICT Literacy	Apply Technology Effectively	Use digital technologies (computers, PDAs, media players, GPS, etc.), communication/networking tools and social networks appropriately to access, manage, integrate, evaluate and create information to successfully function in a knowledge economy		If the coach/mentor deems it appropriate students may use technology to manage their information and communicate with subject-matter experts.

Information, Media and Technology Skills	ICT Literacy	Apply Technology Effectively	Apply a fundamental understanding of the ethical/legal issues surrounding the access and use of information technologies		If a team chooses to create a Compass or Promote video or has to create a League Meet video, they will demonstrate command of issues surrounding the access and use of information technology.
Life and Career Skills	Flexibility and Adaptability	Adapt to Change	Adapt to varied roles, jobs responsibilities, schedules and context		Students will work collaboratively as a team to compete which will include changing roles and responsibilities. On the competition field, alliances have to work together to determine offensive/defensive strategies based on the strengths of each team's robots and the robots they are competing against.
Life and Career Skills	Flexibility and Adaptability	Adapt to Change	Work effectively in a climate of ambiguity and changing priorities		As students research and design their robot, students will have to narrow their focus and define the parameters of their work, while shifting priorities as is necessary.
Life and Career Skills	Flexibility and Adaptability	Be Flexible	Incorporate feedback effectively		Students will incorporate feedback from peers, their coach/mentor, and experts to refine their robot.
Life and Career Skills	Flexibility and Adaptability	Be Flexible	Deal positively with praise, setbacks and criticism		Students will receive feedback from peers, their coach/mentor and experts that they will need to incorporate into their processes and solution.
Life and Career Skills	Flexibility and Adaptability	Be Flexible	Understand, negotiate and balance diverse views and beliefs to reach workable solutions, particularly in multi-cultural environments		Students will work in a collaborative team and must reach agreed upon solutions to complete the competition. Many teams also work with other domestic and international teams. In addition, teams compete in randomly-selected alliances and must work with this partner to obtain points on the competition field.
Life and Career Skills	Initiative and Self-Direction	Manage Goals and Time	Set goals with tangible and intangible success criteria		As part of <i>FIRST@</i> Tech Challenge, students will have to establish goals to create focus for completing and competing with their robot.
Life and Career Skills	Initiative and Self-Direction	Manage Goals and Time	Balance tactical (short-term) and strategic (long-term) goals		Students will have short-term goals to accomplish small tasks that will lead to the long-term goal of designing, building, programming, and operating a robot to complete the tasks on a competition field.
Life and Career Skills	Initiative and Self-Direction	Manage Goals and Time	Utilize time and manage workload efficiently		Students will complete the build of their robot in a specified amount of time established by the team and the competition schedule.
Life and Career Skills	Initiative and Self-Direction	Work Independently	Monitor, define, prioritize and complete tasks without direct oversight		Depending upon how the team is structured, students will have to prioritize and complete tasks without direct oversight.

Life and Career Skills	Initiative and Self-Direction	Be Self-directed Learners	Go beyond basic mastery of skills and/or curriculum to explore and expand one's own learning and opportunities to gain expertise		Teams and students will want to get better at every aspect of the program as they progress. Self-learning and experience are crucial to becoming more successful.
Life and Career Skills	Initiative and Self-Direction	Be Self-directed Learners	Demonstrate initiative to advance skill levels towards a professional level		As part of <i>FIRST®</i> Tech Challenge, students are given the opportunity to explore and deepen their interest and knowledge into any topic to the level that they feel is most appropriate.
Life and Career Skills	Initiative and Self-Direction	Be Self-directed Learners	Demonstrate commitment to learning as a lifelong process		Depending on how the coach/mentor interacts with the team and focuses on teambuilding, students may have an opportunity to discuss career and life-long learning goals. In addition, participating in a <i>FIRST®</i> program may lead to a lifelong engagement with <i>FIRST®</i> as a future mentor, coach, or volunteer.
Life and Career Skills	Initiative and Self-Direction	Be Self-directed Learners	Reflect critically on past experiences in order to inform future progress		Students will examine previous experiences and the processes from past seasons to improve outcomes. If a team uses the self-reflection tools available to them, they will develop the skill of self-assessment and reflection as a method for improving.
Life and Career Skills	Social and Cross-Cultural Skills	Interact Effectively with Others	Know when it is appropriate to listen and when to speak		As part of <i>FIRST®</i> Tech Challenge, students engage in discussions and will have to know when it is appropriate to speak and listen to communicate effectively.
Life and Career Skills	Social and Cross-Cultural Skills	Interact Effectively with Others	Conduct themselves in a respectable, professional manner		As part of <i>FIRST®</i> Tech Challenge, students are expected to conduct themselves in a age-appropriate respectful manner and display Gracious Professionalism® in all activities.
Life and Career Skills	Social and Cross-Cultural Skills	Work Effectively in Diverse Teams	Respect cultural differences and work effectively with people from a range of social and cultural backgrounds		Depending upon the make-up of the team, or the participants at the competitions, students may interact with individuals from a range of social and cultural backgrounds. Many teams also work with other domestic and international teams. In addition, teams compete in randomly-selected alliances and must work with this partner to obtain points on the competition field.
Life and Career Skills	Social and Cross-Cultural Skills	Work Effectively in Diverse Teams	Respond open-mindedly to different ideas and values		In order to develop a collective solution, students will have to be open-minded to different ideas and values.

Life and Career Skills	Social and Cross-Cultural Skills	Work Effectively in Diverse Teams	Leverage social and cultural differences to create new ideas and increase both innovation and quality of work		Depending upon the make-up of the team, or their community, students may be able to leverage social and cultural backgrounds to create an innovative solution. Many teams also work with other domestic and international teams. In addition, teams compete in randomly-selected alliances and must work with this partner to obtain points on the competition field.
Life and Career Skills	Productivity and Accountability	Manage Projects	Set and meet goals, even in the face of obstacles and competing pressure		In order to focus the work, students will need to set and establish both short- and long-term goals in a focused amount of time.
Life and Career Skills	Productivity and Accountability	Manage Projects	Prioritize, plan and manage work to achieve the intended result		Teams will set goals at the beginning of their meetings to help manage what they want to get done in each session and before each competition.
Life and Career Skills	Productivity and Accountability	Produce Results	<p>Demonstrate additional attributes associated with producing high quality products including the abilities to:</p> <ul style="list-style-type: none"> <li>- Work positively and ethically</li> <li>- Manage time and projects effectively</li> <li>- Multi-task</li> <li>- Participate actively, as well as be reliable and punctual</li> <li>- Present oneself professionally and with proper etiquette</li> <li>- Collaborate and cooperate effectively with teams</li> <li>- Respect and appreciate team diversity</li> <li>- Be accountable for results</li> </ul>		Students work collaboratively with their team to build and compete with a robot where each has responsibilities and must manage time and relationships effectively. Many teams also work with other domestic and international teams. In addition, teams compete in alliances and must work with this partner to obtain points on the competition field. All students are expected to maintain Gracious Professionalism® in all activities.
Life and Career Skills	Leadership and Responsibility	Guide and Lead Others	Use interpersonal and problem-solving skills to influence and guide others toward a goal		Students will use interpersonal and problem-solving skills to help their teammates complete tasks and achieve desired goals. Many teams also work with other domestic and international teams. In addition, teams compete in randomly-selected alliances and must work with this partner to obtain points on the competition field.

Life and Career Skills	Leadership and Responsibility	Guide and Lead Others	Leverage strengths of others to accomplish a common goal
Life and Career Skills	Leadership and Responsibility	Guide and Lead Others	Inspire others to reach their very best via example and selflessness
Life and Career Skills	Leadership and Responsibility	Guide and Lead Others	Demonstrate integrity and ethical behavior in using influence and power
Life and Career Skills	Leadership and Responsibility	Be Responsible to Others	Act responsibly with the interests of the larger community in mind

Students will leverage the strengths of their teammates to complete tasks and achieve desired goals while building and competing with the robot. Many teams also work with other domestic and international teams. In addition, teams compete in randomly-selected alliances and must work with this partner to obtain points on the competition field.

Students can inspire teammates through their behavior and actions to complete tasks and achieve desired goals while always displaying Gracious Professionalism® at all times.

Students work collaboratively with peers and are expected to always display Gracious Professionalism®.

Students act in a responsible matter that considers the interests of their team and peers as they choose actions and are expected to always display Gracious Professionalism®.

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