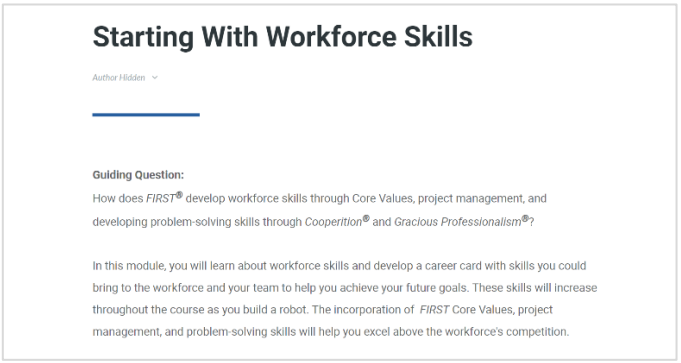
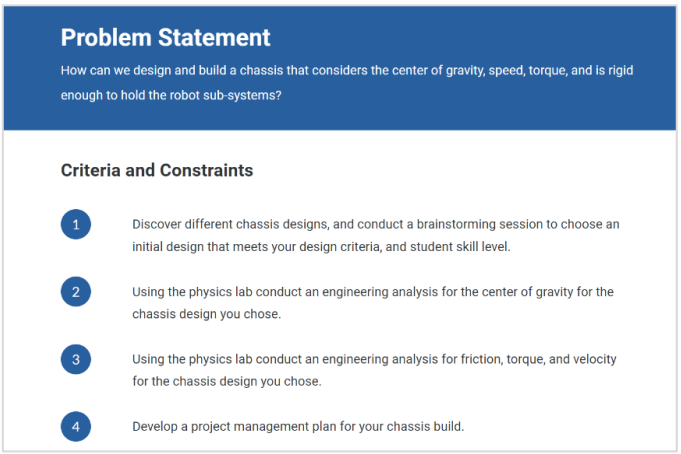
FIRST® Tech Challenge Class Pack Curriculum Overview

Curriculum Design and Flow

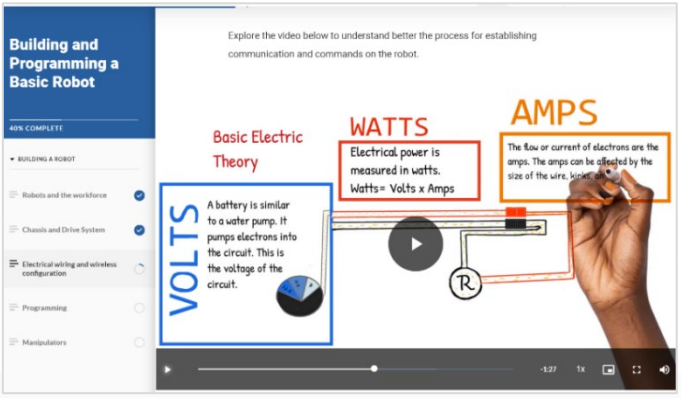
Units are designed with a guiding question and authentic real-world product that helps students achieve workforce, technical or engineering thinking skills.



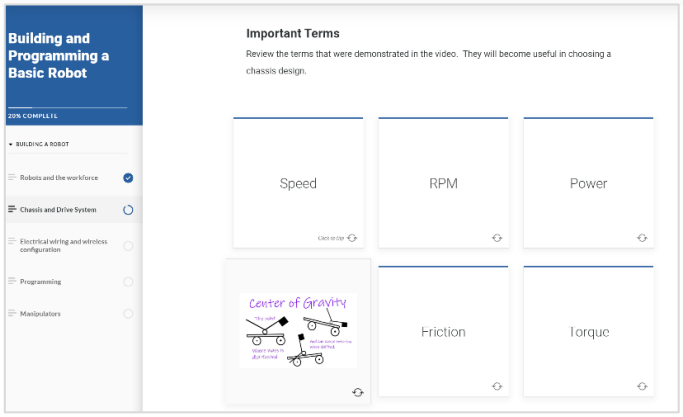
Each lesson has the guiding question, criteria, and constraints to support the question.



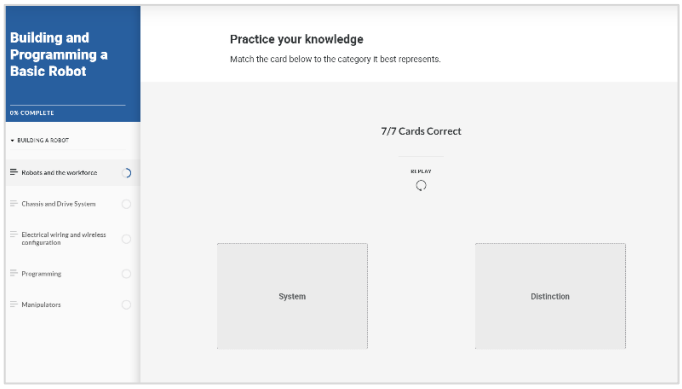
Content knowledge is delivered in a variety of formats including videos, scenarios, processes, and interactive hotspots.



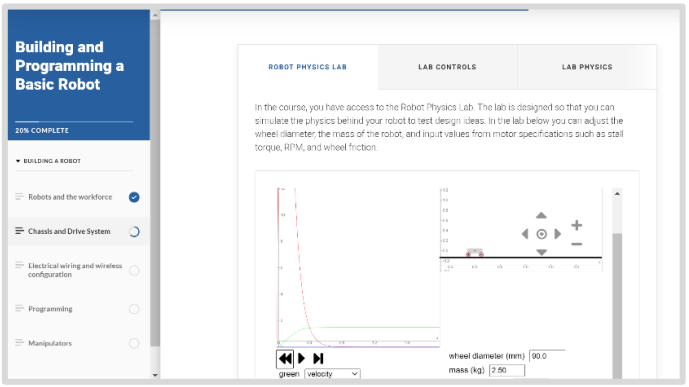
Interactive elements such as flash cards provide opportunities for students to engage in the learning process.



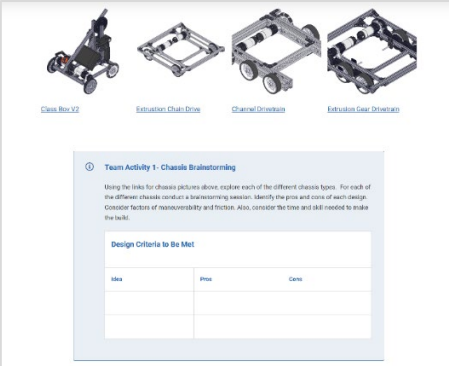
Knowledge checks allow for assessment of learning and feedback to students.



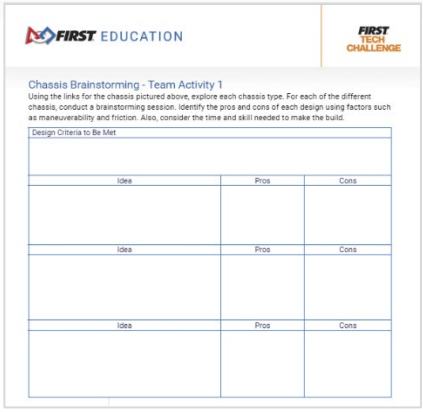
Interactive physics labs allow students to test design ideas and gain understanding of the physics that relate to their design decision.



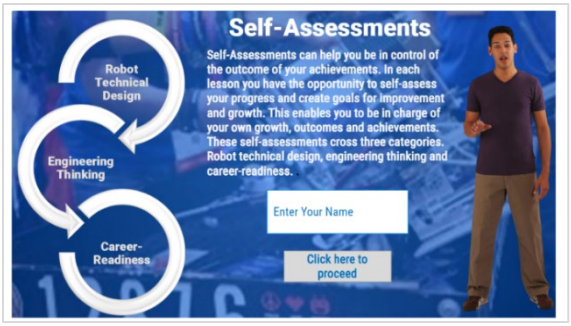
Team activities give students guidance on how to apply their learning to building the robot.



Students document their learning with an engineering notebook. Templates are embedded into the curriculum and can be easily exported to Google or other editing platforms.



Self-assessments tied to course objectives and rubrics are included in each lesson.



Students have the opportunity to earn badges through Tallo.

Semester Course with Beginner Level Students (45-75 Hours)

One semester course only, students in this sequence would not continue to a second semester.

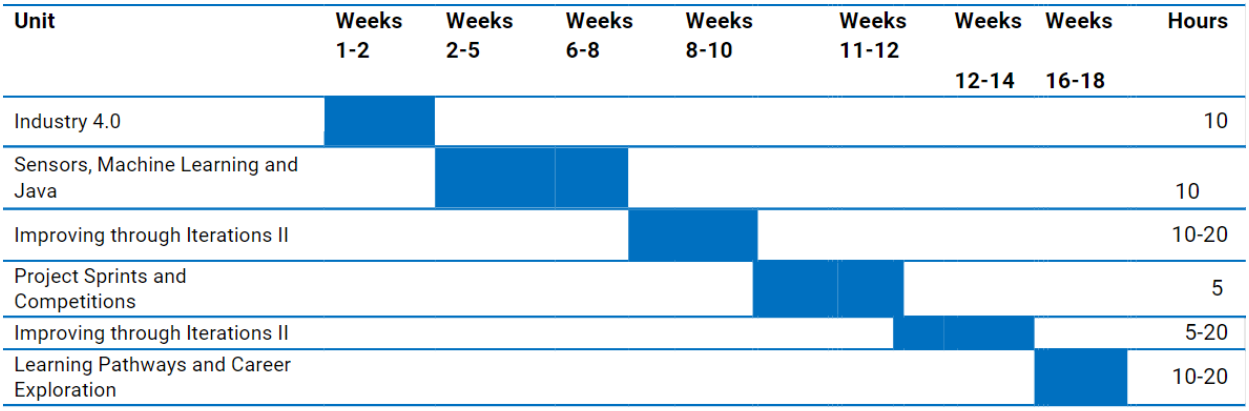
Unit	Weeks 1-2	Weeks 2-5	Weeks 6-8	Weeks 8-10	Weeks 11-12	Weeks 12-14	Weeks 16-18	Hours
Starting with Workforce Skills								10
Building and Programming a Basic Robot								15
Designing for the Game								5-15
Improving through Iterations I								5-15
Project Sprints and Competitions								5-10
Learning Pathways and Career Exploration								5-10

Semester 1: Suggested Sequence of Curriculum Modules

Modules	Lessons	Student Outcomes
Starting with Workforce Skills **10 Hours**	1. Core Values 2. Project Management 3. Tools for Problem Solving 4. Career Card	Students learn about workforce skills through teamwork and problem-solving activities. The incorporation of *FIRST*® Core Values, team purpose, project management, engineering design process, and computational thinking help students develop skills they will use throughout the course which then transfer to the workforce. Students develop their own identity and purpose card as a culminating project.
Building and Programming a Basic Robot **15 hours**	1. Robots and the Workforce 2. Chassis and Drive System 3. Electrical Wiring and Configuration 4. Programming 5. Manipulators	Students work through the process of understanding the fundamentals of a *FIRST*® Tech Challenge robot and building it to plan, sense, and act. They will gain all skills needed to reach the meet category in the Robot Technical Design Rubric. Students will participate in a basic robot challenge, with maneuverability, autonomous, and a basic manipulator.
Designing for the Game **5-15 hours**	1. Game Plan 2. Robot Plan 3. Robot Challenges by Module	Students use computational thinking to break down the problem of the game and develop a game strategy. They then use the engineering design process and with a decision matrix to develop a robot plan. This lesson will also contain challenges that could be completed within other modules.
Machines to Mechanisms **10 hours**	1. Simple to Complex Machines 2. Levers, Cams, and Linkages 3. Conveyors, Intakes, and Trajectory 4. Linear Pulley Systems and Mechanical Advantage	Students can learn the physics fundamentals behind different mechanisms that could be included in a robot design. This includes understanding Newton's laws and its relationship to simple machines involved in the designs. Students will develop and improve robot subsystems to improve a robot design.
Improving with Iterations I **5-20 hours**	1. Iteration and the Product Life Cycle 2. Mechanism Improvement 3. Algorithm Improvement	Students will evaluate the robot through testing and improvements and document the iteration and improvement process of the design.
Project Sprints and Competition **5 hours**	1. Conducting a Project Management Sprint 2. Presentation and Competition	Students will learn how to meet tight deadlines with project management sprints to divide resources for preparing the robot, the notebook, and developing a team presentation.

2nd Semester Course with Advanced Level Students (50-85)

Students in this course would have some design and engineering skills. This is the second semester of a full-year course.



Semester 2: Suggested Sequence of Curriculum Modules

Modules	Lessons	Student Outcomes
Industry 4.0 and Your Community **10 hours**	1. Industry 4.0 2. Community Impact of Industry 4.0 3. Making an Impact for Your Community	Students discover Industry 4.0 technology and how it will change the future workforce. Students will identify possible industries in their area where Industry 4.0 is utilized in the workforce. They will develop a community impact project to use their robot to promote and demonstrate Industry 4.0 technology to their community.
Sensors, Machine Learning and Java **15 hours**	1. State Machines with Sensors and Robot Navigation 2. Developing Robot Machine Learning 3. Object Oriented Programming	Students will learn how to set up programs with automation where they can create functions designed around robot commands. They will use this to increase robot decision making and incorporate more advanced sensor capability such as image recognition.
Improving through Iterations II **5-15 hours**	1. Mechanism Improvement 2. Algorithm Improvement 3. Gathering Data 4. Conducting a Project Management Sprint	Students will use design constraints to develop a project management plan for testing and improvement for their design to meet established constraints and criteria.
Learning Pathways and Career Exploration **15 hours**	1. Engineering Portfolio 2. Resume and Digital Badges 3. Learning Pathways and Competition Teams	Students will explore industry certifications available through *FIRST* and STEM. They will explore learning pathways and work-based learning opportunities while on a *FIRST* Competitive team.

Design Elements

The curriculum scaffolds computational thinking into the engineering design process to help students increase critical thinking and problem-solving skills.

Principles of Computational Thinking

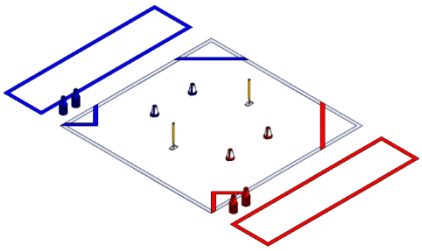
Decomposition

Abstraction

Patter Recognition

Algorithmic Thinking

Project-based learning is achieved through competing with a robot and defending the design process, teamwork, and strategy through presentations. Students develop social emotional learning skills through self-assessment of their performance in the process.



Students explore and apply industry 4.0 skills include big data, Internet of Things, artificial intelligence, and augmented reality through their applications on the robot.