

PROJECT LEAD THE WAY

**PLTW**



**Project Lead The Way Implementation Guide**



## Empower Students to Thrive in an Evolving World

Congratulations! You're one step closer to creating an engaging environment for your students that empowers them to develop the in-demand knowledge and skills necessary to thrive in an evolving world.

Joining the PLTW network means you're part of a community of K-12 PLTW schools, colleges and universities, and corporate and philanthropic partners across the country united around a passion for providing students with inspiring, engaging, and empowering learning opportunities. Once you add PLTW to your district or school, you have access to curriculum, assessments, teacher training, and ongoing program support. PLTW students are afforded a variety of opportunities including scholarships, preferred admission at colleges and universities, internships, industry connections, and avenues to highlight achievements.

**Now, let's get started!**

## Five Steps to Start PLTW at Your District or School

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## Choose the Best PLTW Program(s) for Your District or School

Through PLTW's K-12 pathways in computer science, engineering, and biomedical science, students learn problem-solving strategies, critical and creative thinking, and how to communicate and collaborate. PLTW programs are designed to inspire students to believe in their abilities, test their limits, and question what's possible.

The Activity-, Project-, Problem-Based (APB) instructional model is a cornerstone of the PLTW learning experience. Using this approach, we scaffold knowledge – helping students build on their understanding and gain independence in the learning process, providing opportunities for students to transfer knowledge, and engaging students as they apply their new learnings to a relevant problem.

Through PLTW professional development, teachers learn to lead the engaging PLTW experience in their classrooms. We provide the support and resources they need to devote more time to inspiring students.

Finally, we offer schools and districts flexibility to customize PLTW programs according to student interest, school needs, or local and state requirements.

### Overview of PLTW Programs for K-12

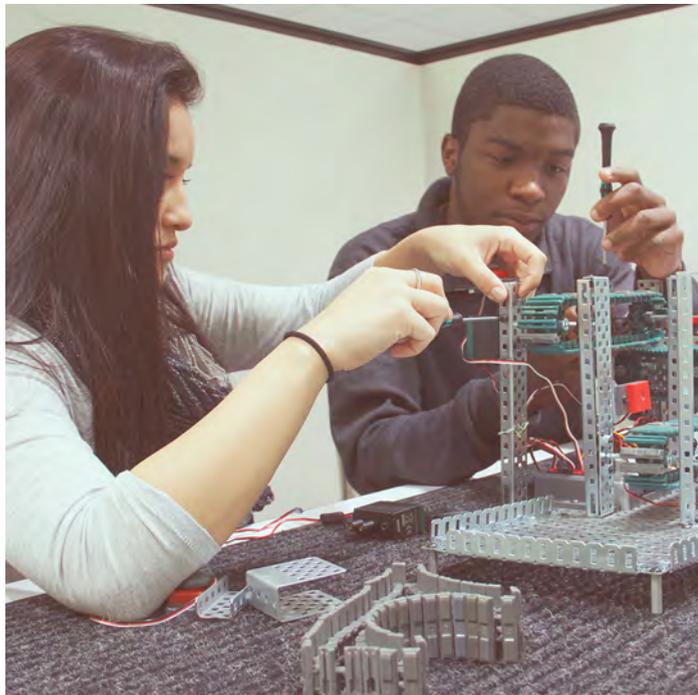
**PLTW Launch (K-5)** taps into students' exploratory nature, engages them in learning that feels like play, and encourages them to keep discovering – now and for years to come. Whether designing a car safety belt or building digital animations, students engage in critical and creative thinking, build teamwork skills, and learn to try and try again when faced with challenges. This program has 24 interdisciplinary 10-hour modules.

**PLTW Gateway (6-8)** illuminates the range of paths and possibilities students can look forward to in high school and beyond. Students apply knowledge and skills from a variety of disciplines, including all three PLTW pathways, in the program's nine-week units. Tackling challenges like designing tires for a moon rover, cleaning up an oil spill, or solving a medical mystery, students learn to test their limits and connect what they learn in the classroom to making a real-world impact.

**PLTW Computer Science (9-12)** engages students in real-world activities like creating an online art portal or using automation to process and analyze DNA-sequence data. These projects illustrate how intricately computer science is woven into our society, challenge students to apply computational thinking and logic to solve big problems, and transform students into builders of tech. This program includes multiple one-year courses.

**PLTW Engineering (9-12)** engages students in collaborative, real-world activities like working with a client to design a home, programming electronic devices or robotic arms, or exploring algae as a biofuel source. By pushing themselves to rework and refine their projects, students learn that both failed attempts and perseverance are key to learning and innovation. This program includes multiple one-year courses.

**PLTW Biomedical Science (9-12)** students step into the roles of medical investigators, surgeons, and biomedical engineers. The program's collaborative, hands-on explorations inspire students to make an impact on the lives of those around them, while preparing them with the know-how and experience to make their ideas a reality. This program includes multiple one-year courses.



## Select Your Program Implementation Approach

Our wide range of program implementation options gives you the flexibility to bring your PLTW program(s) to life in the way that best meets the needs and interests of your students, teachers, school, and community.

This is already happening in more than 8,000 schools across the country. PLTW programs can be found in rural, urban, and suburban districts; across all income levels; as well as in public, private, and charter schools.

In this section, the guide highlights various implementation options and considerations. For each program, we outline the following:

- An overview of how the program was designed
- Detailed information about possible implementation options for a program
- Student readiness considerations to take into account when implementing a program



## PLTW Launch (K-5)

PLTW Launch's 24 modules immerse students in hands-on activities, projects, and problems that build upon each other and relate to the world around them. The program creates an integrated learning experience, blending computer science, engineering, biomedical science, and more.

Throughout PLTW Launch, accompanying e-book stories featuring Angelina, Mylo, and Suzi capture students' imaginations, encourage cross-disciplinary learning, and add relevance to the classroom. The program's flexible 10-hour modules are designed with all the information and materials you need to bring lessons to life for your students and school.

With PLTW Launch, you can choose to start with a single module, implement all 24 modules, or anything between. And no matter what approach you take, PLTW team members will be with you every step of the way to support a successful program implementation and continued growth of your program.

We recommend implementing PLTW Launch using one of the following approaches:

- **One Module per Grade:** Implement one module per grade level during the first year of PLTW Launch. If your school shares iPads® or Android™ tablets across grade levels, this option may be a good starting point. If your school chooses this option, we recommend teaching PLTW Launch modules at different times throughout the year to facilitate tablet sharing.
- **One Module per Grades 3-5:** Implement one module in third, fourth, and fifth grade. This approach allows the students in grades 3-5 to gain PLTW experience and important knowledge and skills before they move on to middle school. This is an effective implementation option if your elementary school feeds into a middle school that already has PLTW Gateway.
- **Multiple Modules per Grade:** Choose this option to add more than one PLTW Launch module per grade. Your school may find it most effective to start with one module per grade in the first part of the school year and then introduce additional modules in the second half of the school year. This option provides students with more PLTW Launch experience than other implementation options. It requires the presence of one or more strong Launch Lead Teacher(s).
- **Pathway Implementation:** Implement PLTW Launch modules aligned to a specific pathway in computer science, engineering, or biomedical science. Your school may prefer this option if your district has a particular pathway focus due to special initiatives or a state requirement. We designed PLTW Launch to introduce students to multiple pathways and content areas, so please consider very carefully before selecting this option.

Once you select your school's implementation option, choose your modules:

### Aligned to Kindergarten Standards

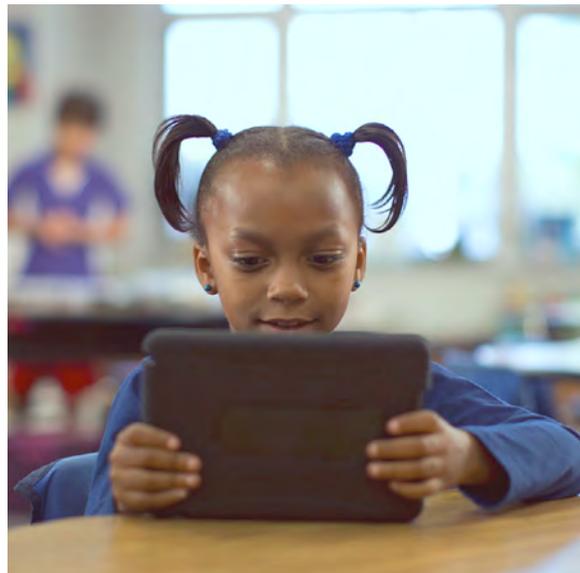
- **Structure and Function – Exploring Design:** Students discover the design process and how engineers influence their lives. They explore the elements of structure and function by identifying products around them designed by engineers and asking questions engineers might ask. They

are introduced to a design problem through a story in which Angelina wants to design a paintbrush. Students apply their knowledge from the module to design their own paintbrushes.

- **Pushes and Pulls** – Students investigate pushes and pulls on the motion of an object and develop knowledge and skills related to forces of differing strengths and directions. Their explorations include pushes and pulls found in their everyday world, such as pushing a friend on a swing or pulling a wagon. In this module’s design problem, Suzi needs to move rocks from her yard so she can install a swing set. Students work through the problem by applying what they learn about forces.
- **Structure and Function: Human Body** – Students explore the relationship between structure and function in the human body. They examine major organs within the body and investigate how the structure of each is related to its function. Students are introduced to the design problem through a story in which Angelina falls off the monkey bars and breaks her arm. Students learn about the diagnosis and treatment of her injury and then work to design and build a cast for Angelina.
- **Animals and Algorithms** – Students explore the nature of computers and the ways humans control and use technology. Starting with an unplugged activity, students learn about the sequential nature of computer programs. Students are inspired by a story in which Angelina, Mylo, and Suzi make videos to teach preschoolers about animals in their habitats. Then, students work in small groups to design and program a simple digital animation about an animal in its habitat.

### Aligned to First Grade Standards

- **Light and Sound** – Students investigate the properties of light and sound, including vibration from sound waves and the effect of different materials on the path of a beam of light. After students develop an understanding of light and sound, they are challenged to solve a design problem Angelina, Mylo, and Suzi face. In the story, the characters are lost and must use only the materials in their backpack to communicate over a distance by using light and/or sound. Students use the design process to sketch, build, test, and reflect on a device that solves this design problem.



- **Light: Observing the Sun, Moon, and Stars** – After observing the sun, moon, and stars, students identify and describe patterns in their recorded data. Angelina, Mylo, and Suzi introduce the design problem, which challenges students to create a playground structure designed to protect students from ultraviolet radiation. Students utilize their knowledge of light to design, build, and test structures created to solve this problem. Students then evaluate their designs, share their findings, and explore ideas to improve their structures based on the testing data.
- **Animal Adaptations** – Students explore animal adaptations for protection, camouflage, food obtainment, and locomotion. Students learn what it means for an organism to be adapted to its environment and how different adaptations can be categorized. Students are introduced to the design challenge when Suzi announces she is visiting the Sahara and needs to get prepared for her trip. Students are challenged to design the ideal shoe for travelers to wear in extreme environments, applying what they have learned and looking to plant and animal adaptations to guide their designs.
- **Animated Storytelling** – Students explore the sequential nature of computer programs through hands-on activities, both with and without a computer. They examine key aspects of storytelling and devise how to transition a narrative from page to screen. Students discover the design problem through a story about Angelina, Mylo, and Suzi, who wish they could find a way to create a story with characters who move and interact with each other. Combining fundamental principles of computer science with story-building skills, students develop animations that showcase characters, settings, actions, and events from short stories of their own creation.

### Aligned to Second Grade Standards

- **Materials Science: Properties of Matter** – Students investigate and classify different kinds of materials by their observable properties, including color and texture. They learn about states of matter and properties of materials including insulators and conductors. In the design problem, Angelina, Mylo, and Suzi, are challenged to keep ice pops cold during a soccer game – without a cooler. Students apply their knowledge and skills to determine the best material to solve this design problem and then evaluate how their designs might be improved.
- **Materials Science: Form and Function** – Students research the variety of ways animals disperse seeds and pollinate plants. They expand their understanding of properties of matter as they



consider the form and function involved in seed dispersal and pollination. Students are introduced to the design problem when Angelina, Mylo, and Suzi are tasked with starting a wildflower garden on an expansive plot outside of their school. To solve the design problem, students apply their knowledge and skills to design, build, test, and reflect on a device that mimics a way in which animals disperse seeds or pollinate plants.

- **The Changing Earth** – Students explore how the surface of the Earth is always changing. They are introduced to different types of maps and explore how these maps convey different information about the world in which we live, including where water is found on Earth. Angelina, Mylo, and Suzi introduce the design problem when faced with the challenge of helping a community threatened by a potential landslide. Students investigate the different forces that shape the surface of the Earth and design solutions to limit the impact of erosion on this fictional community, which is located at the bottom of a hill that was recently destabilized by a fire.
- **Grids and Games** – Students investigate numerical relationships while learning about the sequence and structure required in computer programs. Starting with computer-free activities and moving to tablet-based challenges, students apply addition and subtraction strategies to make characters move on a grid. Angelina presents the design problem when she expresses her desire to design a game she can play on her tablet. Using skills and knowledge gained from these activities, students work together in groups to design and develop a game in which a player interacts with objects on a tablet screen.

### Aligned to Third Grade Standards

- **Stability and Motion: Science of Flight** – In this module, students learn about the forces involved in flight as well as Newton’s Laws of Motion. They design, build, and test an experimental model glider to find out how air and other forces affect its flight. Students discover aeronautics alongside Angelina, Mylo, and Suzi and are inspired by the characters’ desire to use their skills to help those in need. Students apply the design process to the problem of delivering aid to an area where supplies must be airlifted in and dropped to the ground from an aircraft.
- **Stability and Motion: Forces and Interactions** – Students explore simple machines such as wheel and axles, levers, the inclined plane, and more. They investigate the effects of balanced and unbalanced forces on the motion of an object. Angelina, Mylo, and Suzi go on a field trip to the zoo and are faced with the design problem of how to rescue a trapped tiger. Students then apply their knowledge of forces and devise a way to rescue a heavy zoo animal while keeping it safe throughout the process.
- **Variation of Traits** – Students investigate the differences between inherited genetic traits and traits learned or influenced by the environment. They explore the phenomena that offspring may express different traits than parents as they learn about dominant and recessive genes and also investigate how predicted outcomes compare to experimental results. Angelina, Mylo, and Suzi introduce the design problem when challenged to examine different traits found in three sets of seeds. Students then model how the gene for stem color is passed on and expressed among sample sets.
- **Programming Patterns** – This module introduces students to the power of modularity and abstraction. Starting with computer-free activities and progressing to programming in a blocks-based language on a tablet, students learn how to think computationally about a



problem. Angelina, Mylo, and Suzi set the stage for the design problem as they discuss their desire to create video games on their tablet. Students then create a tablet game using modular functions and branching logic.

### Aligned to Fourth Grade Standards

- **Energy: Collisions** – Students explore the properties of mechanisms and how they change energy by transferring direction, speed, type of movement, and force. Students discover a variety of ways potential energy can be stored and released as kinetic energy. They explain the relationship between the speed of an object and the energy of that object, as well as predict the transfer of energy as a result of a collision between two objects. The design problem is introduced by Angelina, Mylo, and Suzi watching amusement park bumper cars collide. As students solve the problem for this module, they apply their knowledge and skills to develop a vehicle restraint system.
- **Energy: Conversion** – Students identify the conversion of energy between forms and the energy transfer required to move energy from place to place. They also identify and explain how energy can be converted to meet a human need or want. The design problem is introduced through Angelina, Mylo, and Suzi, who need to move donated food from a truck to a food pantry. Students then apply scientific ideas about the conversion of energy to solve this design problem.
- **Input/Output: Computer Systems** – In this exploration of how computers work, students are encouraged to make analogies between the parts of the human body and parts that make up a computer. Students investigate reaction time as a measure of nervous system function. After Mylo suffers a concussion, his friends become interested in how to diagnose concussions and create a reaction-time computer program to assess a baseline before a concussion occurs. Students apply what they have learned to build their own reaction-time measurement devices on tablets. This module has strong connections to the fourth-grade Input/Output: Human Brain module.
- **Input/Output: Human Brain** – Students discover how signals passing from cell to cell allow us to receive stimuli from the outside world, transmit this information to the brain for processing, and then send out a signal to generate a response. When Mylo experiences a concussion after falling off a skateboard while not wearing a helmet, he and his friends are motivated to raise awareness about concussions. Inspired by this design problem, students work as part of a team to design, plan, and create a video or podcast to educate children on identifying and preventing concussions.

### Aligned to Fifth Grade Standards

- **Robotics and Automation** – Students explore the ways robots are used in today’s world and their impact on society and the environment. Students learn about a variety of robotic components as they build and test mobile robots that may be controlled remotely. Angelina, Mylo, and Suzi are tasked with designing a mobile robot that can remove hazardous materials from a disaster site. Students are then challenged to design, model, and test a mobile robot that solves this design problem.
- **Robotics and Automation: Challenge** – Students expand their understanding of robotics as they explore mechanical design and computer programming. This module focuses on developing skills needed to build and program autonomous robots. Angelina, Mylo, and Suzi are tasked with designing an automatic-guided vehicle to deliver supplies to a specific area in a hospital without being remotely controlled by a person. Inspired by this design problem, students work with a group to apply their knowledge to design, build, test, and refine a mobile robot that meets a set of design constraints.
- **Infection: Detection** – Students explore transmission of infection, agents of disease, and mechanisms the body uses to stay healthy. Through a simulation, they compare communicable and non-communicable diseases. In the design problem, Suzi comes down with a fever and sore throat, and her friends wonder how this illness might have spread across the school. Students tackle the design problem by examining evidence to deduce the agent of infection, the likely source of the outbreak, and the path of transmission through a school. They design and run an experiment related to limiting the spread of germs and apply results to propose appropriate prevention methods.
- **Infection: Modeling and Simulation** – In this module, students investigate models and simulations and discover powerful ideas about computing. The design problem – related to the Infection: Detection module – is introduced as Mylo and Angelina look to model an infectious disease to simulate how an illness spread through their class. Applying their new understandings, students program their own models and collect data by running simulations with different parameters.





## PLTW Gateway (6-8)

PLTW Gateway's hands-on activities, projects, and problems in computer science, engineering, and biomedical science boost classroom engagement and excitement, support student-led learning and teamwork, and inspire “aha! moments” and deep comprehension. PLTW Gateway is divided into independent, nine-week units, assuming a 45-minute class period and is designed to be taught in conjunction with a challenging academic curriculum.

With PLTW Gateway, you can choose to start with a single unit, implement all ten units, or anything between. And no matter what approach you take, PLTW team members will be with you every step of the way to support a successful program implementation and continued growth of your program.

We recommend implementing PLTW Gateway using one of the following approaches:

- **Sequenced Implementation:** Start with the two foundation units (Design and Modeling; Automation and Robotics) followed by one or more specialization units. This option provides students with a strong foundation in the engineering design process before they start taking more specialized units.
- **Pathway Implementation:** Implement PLTW Gateway units aligned to a specific pathway. Your school may prefer this option if your district has a particular pathway focus due to special initiatives or a state requirement. This option also works well if your school would like to start your PLTW Gateway program with computer science units rather than the foundation units. Typically, we recommend schools give middle school students experience with all three pathways.

The table below illustrates how the PLTW Gateway units align to each of the three PLTW pathways.

PLTW Gateway Units	Computer Science	Engineering	Biomedical Science
Design and Modeling	X	X	X
Automation and Robotics		X	
Energy and the Environment		X	
Flight and Space		X	
Green Architecture		X	
Magic of Electrons		X	
Science of Technology		X	
Introduction to Computer Science 1	X		
Introduction to Computer Science 2	X		
Medical Detectives			X

- **Feeder School Implementation:** Develop a PLTW Gateway program based on the PLTW courses offered at the high school that students will later attend. This approach allows your middle school to help prepare students for the type of PLTW courses they may take in high school. For example, if the high school has an established PLTW Engineering program with a focus on Aerospace Engineering, then your school may want to select Flight and Space as a specialization unit.

The table below illustrates how the units align to high school PLTW courses or programs.

PLTW Gateway Units	Related PLTW High School Course/Program
Design and Modeling	Introduction to Engineering Design
Automation and Robotics	Principles of Engineering
Energy and the Environment	Environmental Sustainability
Flight and Space	Aerospace Engineering
Green Architecture	Civil Engineering and Architecture
Magic of Electrons	Digital Electronics
Science of Technology	Principles of Engineering
Introduction to Computer Science 1	Computer Science Principles
Introduction to Computer Science 2	Computer Science Principles
Medical Detectives	PLTW Biomedical Science Program

- **Access for Every Grade Level:** Offer at least one unit for every grade level. This implementation option ensures that all of your middle school students have access to a PLTW Gateway unit.

Once you select your school’s implementation approach, it’s time to choose your units:

**Foundation Units**

- **Design and Modeling** – Students apply the design process to solve problems and understand the influence of creativity and innovation in their lives. Using Autodesk® software, students create a virtual image of their designs and produce a portfolio to showcase their innovative solutions.

*Student Readiness Consideration: Design and Modeling is designed for sixth, seventh, and eighth grade students.*

- **Automation and Robotics** – Students trace the history, development, and influence of automation and robotics as they learn about mechanical systems, energy transfer, machine automation, and computer control systems. Students use the VEX Robotics® platform to design, build, and program real-world objects such as traffic lights, toll booths, and robotic arms.

*Student Readiness Consideration: Automation and Robotics is designed for seventh and eighth grade students. We recommend that students complete Design and Modeling or the two introductory lessons before beginning this unit.*

**Specialization Units**

- **Introduction to Computer Science 1** – In this unit, students discover the principles of this fast-growing field by focusing on creativity and an iterative design process as they create their own basic apps using MIT App Inventor®.

*Student Readiness Consideration: Introduction to Computer Science 1 is designed for seventh and eighth grade students.*

- **Introduction to Computer Science 2** – Students continue to explore the fundamentals of the stimulating career path of computer science. They venture into text programming through Python® and, in the final problem, develop an app to crowdsource and analyze data on a topic of their interest.

*Student Readiness Consideration: Introduction to Computer Science 2 is designed for seventh and eighth grade students. We recommend that students complete Introduction to Computer Science 1 before beginning this unit.*

- **Energy and the Environment** – Students are challenged to think big and toward the future as they explore sustainable solutions to our energy needs and investigate the impact of energy on our lives and the world. They design and model alternative energy sources and evaluate options for reducing energy consumption.



*Student Readiness Consideration: Energy and the Environment is designed for sixth, seventh, and eighth grade students. We recommend that students complete Design and Modeling or the two introductory lessons before beginning this unit.*

- **Flight and Space** – The exciting world of aerospace comes alive through Flight and Space. Students explore the science behind aeronautics and use their knowledge to design, build, and test an airfoil.

*Student Readiness Consideration: Flight and Space is designed for sixth, seventh, and eighth grade students. We recommend that students complete Design and Modeling or the two introductory lessons before beginning this unit.*

- **Science of Technology** – Science impacts the technology of yesterday, today, and the future. Students apply the concepts of physics, chemistry, and nanotechnology to STEM activities and projects, including making ice cream, cleaning up an oil spill, and discovering the properties of nano-materials.

*Student Readiness Consideration: Science of Technology is designed for sixth, seventh, and eighth grade students. We recommend that students complete Design and Modeling or the two introductory lessons before beginning this unit.*

- **Magic of Electrons** – Through hands-on projects, students explore electricity, the behavior and parts of atoms, and sensing devices. They learn knowledge and skills in basic circuitry design, and examine the impact of electricity on the world around them.

*Student Readiness Consideration: Magic of Electrons is designed for seventh and eighth grade students. We recommend that students complete Design and Modeling or the two introductory lessons before beginning this unit.*

- **Green Architecture** – Today’s students have grown up in an age of “green” choices. In this unit, students learn how to apply this concept to the fields of architecture and construction by exploring dimensioning, measuring, and architectural sustainability as they design affordable housing units using Autodesk’s® 3D architectural design software.

*Student Readiness Consideration: Green Architecture is designed for sixth, seventh, and eighth grade students. We recommend that students complete Design and Modeling or the two introductory lessons before beginning this unit.*

- **Medical Detectives** – Students play the role of real-life medical detectives as they analyze genetic testing results to diagnose disease and study DNA evidence found at a “crime scene.” They solve medical mysteries through hands-on projects and labs, investigate how to measure and interpret vital signs, and learn how the systems of the human body work together to maintain health.

*Student Readiness Consideration: Medical Detectives is designed for seventh and eighth grade students. We recommend that students complete Design and Modeling or the two introductory lessons before beginning this unit.*



## PLTW Computer Science (9-12)

PLTW Computer Science empowers students to become creators, instead of merely consumers, of the technology all around them. The program engages students in real-world activities like creating an online art portal and using automation to process and analyze DNA-sequence data. These projects and problems challenge students to think big and help illustrate how intricately computer science is woven into our society.

With PLTW Computer Science, you can choose to start with a single course, implement all four courses, or anything between. And no matter what approach you take, PLTW team members will be with you every step of the way to support a successful program implementation and continued growth of your program.

We recommend implementing PLTW Computer Science using one of the following approaches:

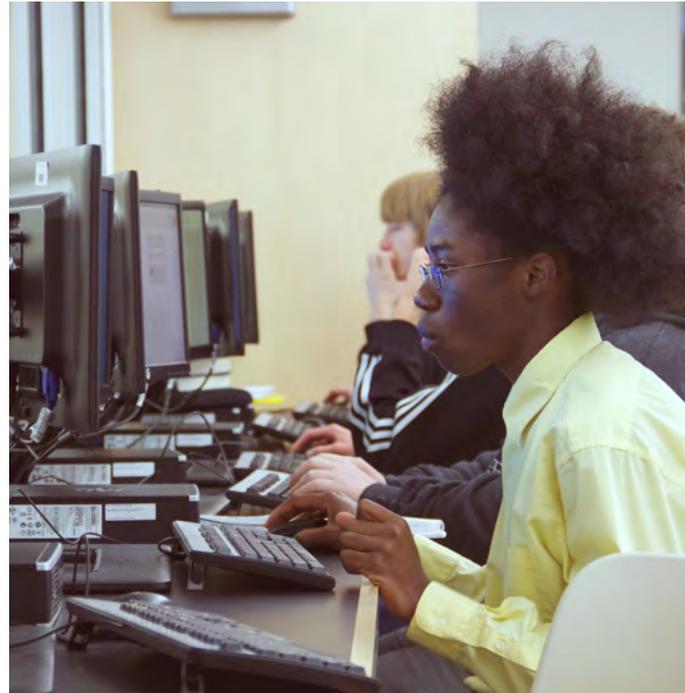
- **Sequenced Implementation:** Implement the PLTW Computer Science program in the sequence it was designed. Your school would start by offering Introduction to Computer Science followed by Computer Science Principles, Computer Science A, and Cybersecurity. This option provides students with a strong computer science foundation before they start taking more advanced programming courses.
- **Accelerated Implementation:** Begin with Computer Science Principles or Computer Science A followed by a specialization course. This approach will work best if students in your school already have a strong computer science background from taking either PLTW Gateway computer science units or non-PLTW computer science courses. This option also works well for schools with a strong AP program, as both Computer Science Principles and Computer Science A are aligned to AP frameworks.
- **Start with Computer Science Principles:** This option works well if your school is trying to decide between offering PLTW Computer Science or PLTW Engineering as a first program. The PLTW Computer Science Principles course is part of both programs, allowing schools to see which pathway students are most interested in after taking the course. This approach can help schools determine which to offer first and grow from there.

Once you select your school's implementation approach, it's time to choose your courses:

- **Introduction to Computer Science (ICS, 0.5 year)** – Designed to be the first computer science course for students who have never programmed before, ICS is an optimal starting point for the PLTW Computer Science program. Students work in teams to create apps for mobile devices using MIT App Inventor®. They explore the impact of computing in society and build skills in digital citizenship and cybersecurity. Beyond learning the fundamentals of programming, students build computational thinking skills by applying computer science to collaboration tools, modeling and simulation, and data analysis. In addition, students transfer the understanding of programming gained

in App Inventor to text-based programming in Python® and apply their knowledge to create algorithms for games of chance and strategy.

*Student Readiness Consideration: This course is ideal for students with no prior knowledge of computer science. The pace is moderate with a significant amount of interdisciplinary content.*



- **Computer Science Principles (CSP, 1 year)** – Using Python® as a primary tool and incorporating multiple platforms and languages for computation, this course aims to develop computational thinking, generate excitement about career paths that utilize computing, and introduce professional tools that foster creativity and collaboration. CSP helps students develop programming expertise and explore the workings of the Internet. Projects and problems include app development, visualization of data, cybersecurity, and simulation. The course aligns to the AP CS Principles framework.

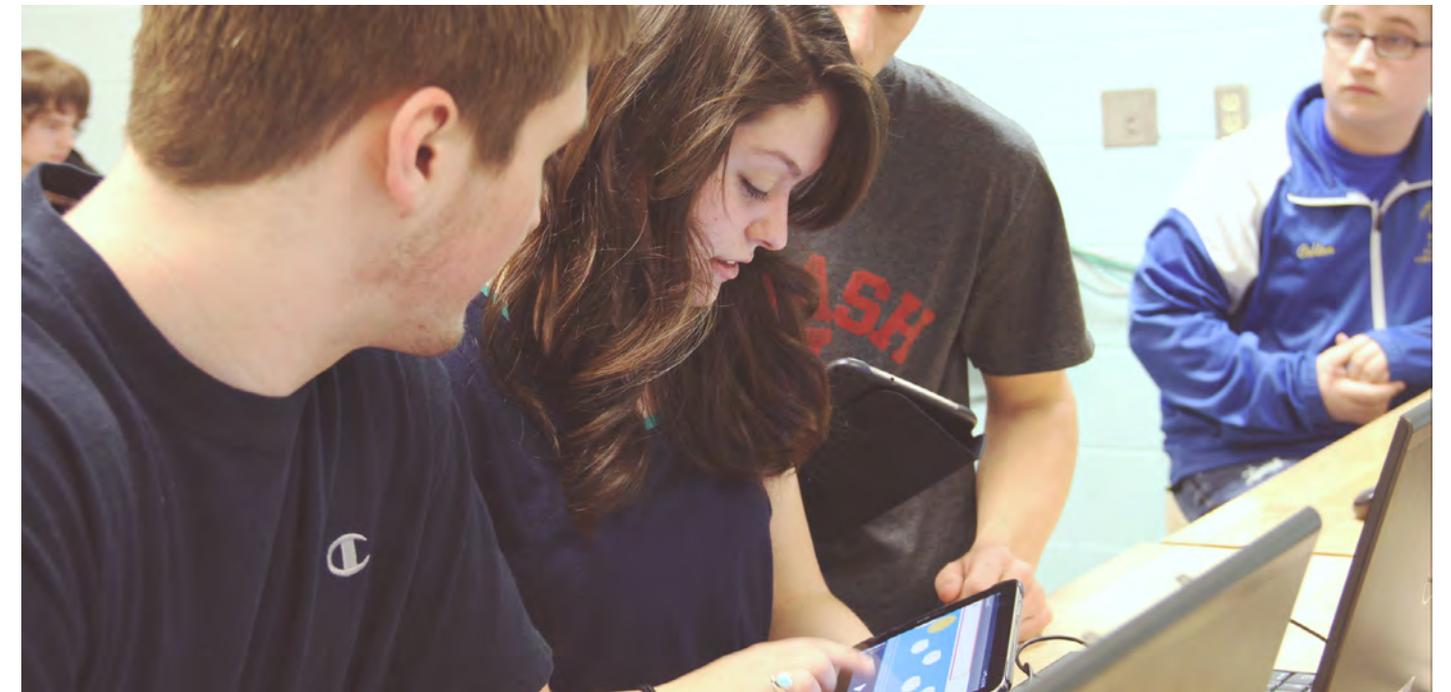
*Student Readiness Consideration: Computer Science Principles is well-suited for a student who has completed Introduction to Computer Science or another introductory computer science course.*

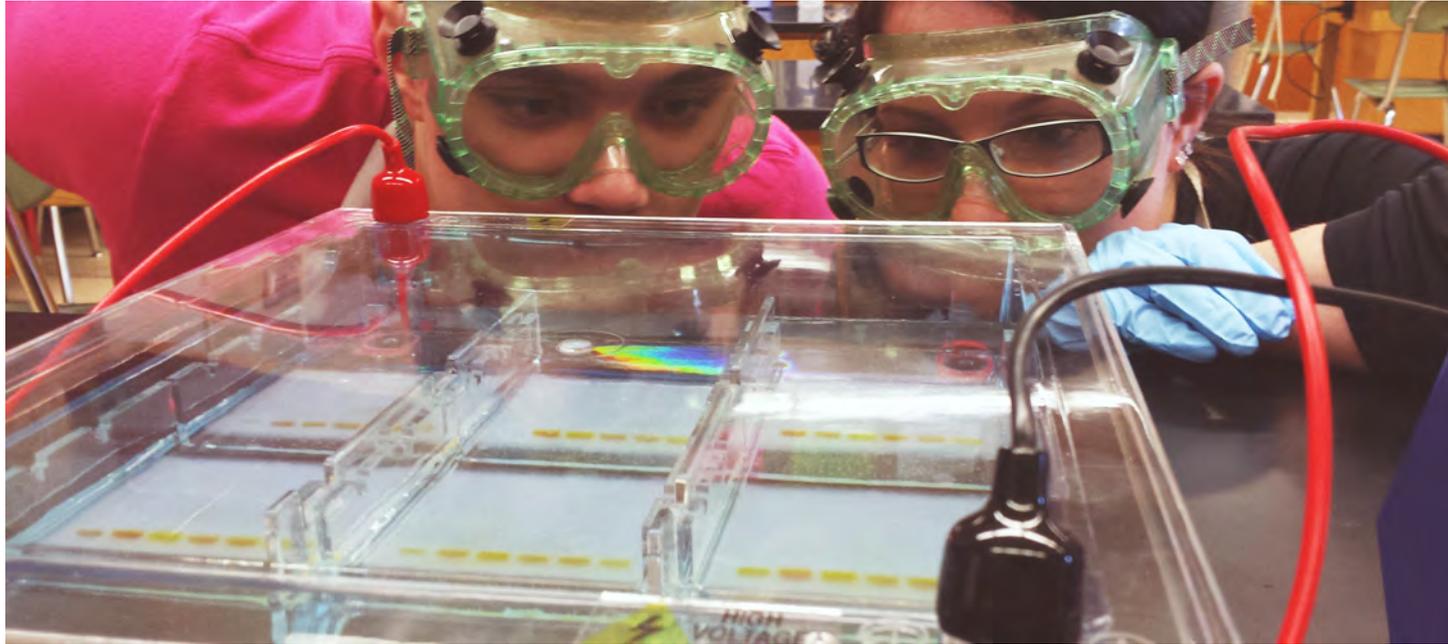
- **Computer Science A (CSA, 1 year)** – CSA focuses on further developing computational thinking skills through the medium of Android™ App development for mobile platforms. The course utilizes industry-standard tools such as Android Studio, Java™ programming language, XML, and device emulators. Students collaborate to create original solutions to problems of their own choosing by designing and implementing user interfaces and Web-based databases. The course aligns to the AP Computer Science A framework.

*Student Readiness Consideration: Computer Science A assumes students have the knowledge gained in Introduction to Computer Science and Computer Science Principles, including how to use conditional statements and iteration and how to form programmatic statements in text-based language. This course also assumes the successful completion of Algebra I.*

- **Cybersecurity (SEC, 1 year)** – SEC introduces the tools and concepts of cybersecurity and encourages students to create solutions that allow people to share computing resources while protecting privacy. Nationally, computational resources are vulnerable and frequently attacked; in SEC, students solve problems by understanding and closing these vulnerabilities. This course raises students' knowledge of and commitment to ethical computing behavior. It also aims to develop students' skills as consumers, friends, citizens, and employees who can effectively contribute to communities with a dependable cyber-infrastructure that moves and processes information safely.

*Cybersecurity will be available in the 2018-19 school year.*





## PLTW Engineering (9-12)

PLTW Engineering empowers students to step into the role of an engineer and adopt a problem-solving mindset. The program engages students in collaborative, real-world activities like working with a client to design a home, programming electronic devices or robotic arms, or exploring algae as a biofuel source. As students work together to design and develop solutions to local and global challenges, they engage in problem-solving strategies and critical and creative thinking. The program's sequence of full-year courses empowers students to develop in-demand knowledge and skills they'll use in high school and for the rest of their lives, on any career path they take.

With PLTW Engineering, you can choose to start with a single course, implement all nine courses, or anything between. And no matter what approach you take, PLTW team members will be with you every step of the way to support a successful program implementation and continued growth of your program.

We recommend implementing PLTW Engineering using one of the following approaches:

- **Sequenced Implementation:** Start with implementing Introduction to Engineering Design followed by Principles of Engineering. Once you have implemented these two courses, your school would offer one or more specialization courses followed by the capstone course, Engineering Design and Development. This implementation option provides students with a strong engineering foundation before they start taking specialized courses.
- **Accelerated Implementation:** Start with Introduction to Engineering Design and then add one or more specialization courses. This approach allows students to still receive a foundational understanding of engineering while also providing them with faster access to specialization courses. Your school may choose to move directly into offering PLTW specialization courses if your school already has other introductory engineering courses in place.
- **Community-Oriented Implementation:** Implement a PLTW Engineering specialization course first. This may be a good option if your school's local community has a strong tie to a specific industry. While we recommend that students have a strong engineering foundation before taking a specialization course, it is possible for your students to be successful in a specialization course before taking one of the foundational courses.
- **Start with Computer Science Principles:** This option works well if your school is trying to decide between offering PLTW Computer Science or PLTW Engineering as a first program. The PLTW Computer Science Principles course is part of both programs, allowing schools to see which pathway students are most interested in after taking the course. This approach can help schools determine which to offer first and grow from there.

Once you select your school's implementation option, it's time to choose your courses:

### Foundation Courses

- **Introduction to Engineering Design (IED, 1 year)** – Students dig deep into the engineering design process, applying math, science, and engineering standards to hands-on projects. They work both individually and in teams to design solutions to a variety of problems using 3D modeling software, and use an engineering notebook to document their work.

*Student Readiness Consideration: Introduction to Engineering Design assumes a student has successfully completed Algebra I or is concurrently enrolled in the course.*

- **Principles of Engineering (POE, 1 year)** – Through problems that engage and challenge, students explore a broad range of engineering topics, including mechanisms, the strength of structures and materials, and automation. Students develop skills in problem solving, research, and design while learning strategies for design process documentation, collaboration, and presentation.

*Student Readiness Consideration: Principles of Engineering assumes the successful completion of Algebra I. We strongly recommend a student successfully complete Introduction to Engineering before beginning this course. We also recommend students are concurrently enrolled in Geometry and are ready to learn basic trigonometric concepts.*

### Specialization Courses

- **Aerospace Engineering (AE, 1 year)** – This course propels students' learning in the fundamentals of atmospheric and space flight. As they explore the physics of flight, students bring the concepts to life by designing an airfoil, propulsion system, and rockets. They learn basic orbital mechanics using industry-standard software. They also explore robot systems through projects such as remotely operated vehicles.

*Student Readiness Consideration: Aerospace Engineering assumes student knowledge and experience from PLTW foundation courses. It also assumes the completion of Algebra I and Geometry.*



- **Civil Engineering and Architecture (CEA, 1 year)** – Students learn important aspects of building and site design and development. They apply math, science, and standard engineering practices to design both residential and commercial projects and document their work using 3D architecture design software.

*Student Readiness Consideration: Civil Engineering and Architecture assumes student knowledge and experience from PLTW foundation courses. It also assumes the completion of Algebra I and Geometry.*

- **Computer Integrated Manufacturing (CIM, 1 year)** – Manufactured items are part of everyday life, yet most students have not been introduced to the high-tech, innovative nature of modern manufacturing. This course illuminates the opportunities related to understanding manufacturing. At the same time, it teaches students about manufacturing processes, product design, robotics, and automation. Students can earn a virtual manufacturing badge recognized by the National Manufacturing Badge system.

*Student Readiness Consideration: Computer Integrated Manufacturing assumes student knowledge and experience from PLTW foundation courses. It also assumes the completion of Algebra I and Geometry.*

- **Computer Science Principles (CSP, 1 year)** – Using Python® as a primary tool and incorporating multiple platforms and languages for computation, this course aims to develop computational thinking, generate excitement about career paths that utilize computing, and introduce professional tools that foster creativity and collaboration. CSP helps students develop programming expertise and explore the workings of the Internet. Projects and problems include app development, visualization of data, cybersecurity, and simulation. The course aligns to the AP CS Principles framework.

*Student Readiness Consideration: Computer Science Principles is well-suited for a student who has completed Introduction to Computer Science or another introductory computer science course.*

- **Digital Electronics (DE, 1 year)** – From smart phones to appliances, digital circuits are all around us. This course provides a foundation for students who are interested in electrical engineering, electronics, or circuit design. Students study topics such as combinational and sequential logic and are exposed to circuit design tools used in industry, including logic gates, integrated circuits, and programmable logic devices.

*Student Readiness Consideration: Digital Electronics assumes student knowledge and experience from PLTW foundation courses. It also assumes the completion of Algebra I and Geometry.*

- **Environmental Sustainability (ES, 1 year)** – In ES, students investigate and design solutions in response to real-world challenges related to clean and abundant drinking water, food supply issues, and renewable energy. Applying their knowledge through hands-on activities and simulations, students research and design potential solutions to these true-to-life challenges.



*Student Readiness Consideration: Environmental Sustainability assumes student knowledge and experience from PLTW foundation courses. It also assumes the completion of Algebra I and Geometry. We also strongly recommend that students successfully complete at least one biology course before beginning this course.*

### Capstone Course

- **Engineering Design and Development (EDD, 1 year)** – The knowledge and skills students acquire throughout PLTW Engineering come together in EDD as they identify an issue and then research, design, and test a solution, ultimately presenting their solution to a panel of engineers. Students apply the professional skills they have developed to document a design process to standards, completing EDD ready to take on any post-secondary program or career.

*Student Readiness Consideration: Engineering Design and Development assumes student knowledge and experience from PLTW foundation courses. It also assumes the completion of Algebra I and Geometry.*





## PLTW Biomedical Science (9-12)

Working with the same tools used by professionals in hospitals and labs, PLTW Biomedical Science students step into the roles of medical investigators, surgeons, microbiologists, geneticists, and biomedical engineers. They explore realistic situations like investigating the death of a fictional person and analyzing prevention, diagnosis, and treatment of disease. The program's collaborative, hands-on explorations inspire students to discover the diversity of biomedical science careers and empower them to develop the knowledge and skills to make their life-changing ideas a reality. This program is organized in a sequence of full-year courses.

With PLTW Biomedical Science, you can choose to start with a single course, implement all four courses, or anything between. And no matter what approach you take, PLTW team members will be with you every step of the way to support a successful implementation and continued growth of your program.

We recommend implementing PLTW Biomedical Science using one of the following approaches:

- **Sequenced Implementation:** Implement the PLTW Biomedical Science program in the order it was designed. This means the program would start with Principles of Biomedical Science followed by Human Body Systems, Medical Interventions, and Biomedical Innovation. In this scenario, students would take all four courses in sequence by taking one course per year or two courses concurrently. Schools with block scheduling may need to offer courses concurrently. If this is the case, Principles of Biomedical Science and Human Body Systems should be scheduled so students can take them concurrently, followed by concurrent offerings of Medical Interventions and Biomedical Innovation.
- **Accelerated Implementation:** Start with Human Body Systems. This approach will work well in schools that require students to complete a general biology course before taking Human Body Systems. This scenario will be successful if students have experience working independently and in teams to design experiments and have experience with independent project-based work.

It's also possible for a school to start off its program with Medical Interventions if students have completed AP Biology, a human anatomy and physiology course, and/or a course covering medical diagnostics, biotechnology, microbiology, or molecular biology. This scenario will be successful if students are comfortable with project-based learning and have experience and confidence working independently and in groups.

Once you select your school's implementation option, choose your courses:

### Foundation Courses

- **Principles of Biomedical Science** – In the introductory course of the PLTW Biomedical Science program, students explore concepts of biology and medicine to determine factors that led to the death of a fictional person. While investigating the case, students examine autopsy reports, investigate medical history, and explore medical treatments that might have prolonged the person's life. The activities and projects introduce students to human physiology, basic biology, medicine, and research processes while allowing them to design their own experiments to solve problems.



*Student Readiness Consideration: Principles of Biomedical Science assumes concurrent enrollment in grade-level math and completion or concurrent enrollment in high school biology.*

- **Human Body Systems** – Students examine the interactions of human body systems as they explore identity, power, movement, protection, and homeostasis. Exploring science in action, students build organs and tissues on a skeletal Maniken®; use data acquisition software to monitor body functions such as muscle movement, reflex and voluntary action, and respiration; and take on the roles of biomedical professionals to solve real-world medical cases.

*Student Readiness Consideration: Human Body Systems assumes student knowledge from Principles of Biomedical Science including a general understanding of maintenance of homeostasis in the human body, metabolism, cellular transport, enzyme action, genetics, and defense against disease. This course assumes basic proficiency with experimental design and general laboratory skills, as well as concurrent enrollment in grade-level math and science. We strongly recommend that students*

*have successfully completed biology before beginning this course.*

- **Medical Interventions** – Students follow the life of a fictitious family as they investigate how to prevent, diagnose, and treat disease. Students explore how to detect and fight infection; screen and evaluate the code in human DNA; evaluate cancer treatment options; and prevail when the organs of the body begin to fail. Through real-world cases, students are exposed to a range of interventions related to immunology, surgery, genetics, pharmacology, medical devices, and diagnostics.

*Student Readiness Consideration: Medical Interventions assumes student knowledge from Principles of Biomedical Science and Human Body Systems including a general understanding of maintenance of homeostasis in the human body, metabolism, cellular transport, enzyme action, genetics, defense against disease, and structure and function in the human body. This course assumes basic proficiency with experimental design and general laboratory skills. This course is an excellent complement to anatomy and physiology, genetics, and forensics.*

### **Capstone Course**

- **Biomedical Innovation** – In the final course of the PLTW Biomedical Science sequence, students build on the knowledge and skills gained from previous courses to design innovative solutions for the most pressing health challenges of the 21st century. Students address topics ranging from public health and biomedical engineering to clinical medicine and physiology. They have the opportunity to work on an independent design project with a mentor or advisor from a university, medical facility, or research institution.

*Student Readiness Consideration: Biomedical Innovation assumes student knowledge from Principles of Biomedical Science, Human Body Systems, and Medical Interventions including a general understanding of maintenance of homeostasis in the human body, metabolism, cellular transport, enzyme action, genetics, defense against disease, and structure and function in the human body. This course assumes basic proficiency with experimental design and general laboratory skills.*



## Build Your Foundation

Now that you've selected the best implementation approach for your students and school, it's time to start the process of setting up your PLTW program(s). During this process, you'll register your district and/or school with PLTW, select your PLTW Teachers, and order the necessary equipment and supplies for your PLTW program(s). You'll have access to our team of experts throughout this entire process to provide you with guidance and answer any of your questions.

### Register Your District and/or School

Once you've decided to add a PLTW program to your school, you then complete the online registration form(s). If your school district is starting PLTW for the first time, you'll complete the online District Registration and School Registration forms. If your school district already has PLTW and you are adding PLTW to a new school, you will simply complete the online School Registration form.

### Starting PLTW in a District

As part of the new district registration, you'll provide contact information for your District Administrator, Superintendent, and primary billing contact. The District Administrator is an important role for your PLTW program(s) and serves as the primary contact between PLTW and the entire district. You'll also identify a School Administrator for each school you register. The School Administrator serves as the primary contact between your school and PLTW.

After you've completed your online registration, the PLTW Solution Center reviews your registration form(s) and contacts you if they have any questions. Then, a member of the PLTW Solution Center sends you the PLTW Terms and Conditions. Your District Signatory reviews and signs the PLTW Terms and Conditions and returns a copy of the signed document to the PLTW Solution Center. Once the signed PLTW Terms and Conditions is processed, your District Administrator receives an executed copy of the PLTW Terms and Conditions.

Next, your District Administrator and/or School Administrator should reach out to the PLTW Solution Center to add new district or school contacts that will be involved with PLTW program(s).

### Select Your PLTW Teachers

One of the most influential components of your PLTW program(s) will be the teacher(s) you choose for your PLTW modules, units, or courses. Your PLTW Teachers will be essential in the implementation and overall success of your PLTW program(s). They also can be some of the biggest champions for your PLTW program(s) within the district, school, and community.

PLTW Teachers come from a variety of different backgrounds and experiences, yet they share a few key characteristics. Successful PLTW Teachers are excited to transform their classrooms, eager to learn and employ project-based learning, and passionate about empowering students to develop in-demand knowledge and skills.

*PLTW Launch Lead Teacher Considerations: Schools implementing PLTW Launch will select one or more PLTW Launch Lead Teachers to attend PLTW Core Training. PLTW Launch Lead Teachers return to their*



*school to train other teachers to implement PLTW Launch modules. PLTW Launch Lead Teachers also provide guidance on implementation and supply and equipment management at the school site.*

### **Engage in PLTW Professional Development**

PLTW Teachers participate in three phases of professional development, which provide learning opportunities that emphasize proper preparation, in-depth training, and continuing education. The three phases are Readiness Training, Core Training, and Ongoing Training. PLTW Professional Development is designed to quickly immerse teachers in the PLTW approach and empower them to bring the curriculum to life in their classrooms.

After you've identified PLTW teachers, the next step is for them to begin Readiness Training. Readiness Training helps prepare teachers with technical and content knowledge prior to beginning Core Training. For middle and high school programs, Readiness Training is available online.

Once teachers complete Core Training, they have access to Ongoing Training, which consists of self-paced online resources, face-to-face state conferences and the PLTW Summit, and our Professional Learning Communities. Ongoing Training includes resources that encourage teachers to deepen their understanding of teaching practices and content knowledge embedded in PLTW courses.

*For PLTW Launch, the PLTW Launch Lead Teacher completes online Readiness Training and a three-day face-to-face Core Training experience. PLTW Launch Lead Teachers then conduct Building-Level Readiness Training at their school site for all teachers who plan to implement PLTW Launch modules. All PLTW Launch Teachers complete online Core Training specific to each module they plan to teach.*

### **Order Equipment and Supplies**

Another key component to setting up your PLTW program(s) is ordering the necessary equipment and supplies your students and teachers need for their PLTW experience. PLTW courses integrate equipment, technology, and supplies into the curriculum to give students hands-on experiences and opportunities to apply what they learn in a meaningful way. Students have access to equipment and software employed by industry, so that they can see the real-world implications of what they learn.

When you're ready to order equipment and supplies for your PLTW program(s), we recommend reviewing our [Purchasing Manual Instructions](#) and using the [Program Inventory and Supplies Workbooks](#) to determine what you need.



## Meet myPLTW

Think of myPLTW as the nerve center for your PLTW experience. It contains all of the information and resources you'll need to implement, manage, and grow your PLTW program(s). myPLTW provides access to student rostering and enrollment, the myPLTW Learning Management System (LMS), Professional Learning Communities (PLCs), and End-of-Course (EoC) assessments.

### Access myPLTW

The first step in gaining access to myPLTW is to create an account. You will want your District Administrator, School Administrator, Principal, and all PLTW Teachers to create a myPLTW account once your district and/or school's registration is completed.

Please follow the steps below to create a myPLTW account:

1. Visit [my.pltw.org](https://my.pltw.org) and click "Create a new account".
2. Enter your school email address in the "Email Address" field.
3. Read the Terms and Conditions applicable for your role and then mark the "I Agree" checkbox.
4. Click "Register".
5. An email will be sent to the email address you provided with a one-time link to use to create your password. This link will expire in 30 days.
6. Once you have received the email, click on the link in the email and then click "Log in".
7. Enter your password and then click "Save".
8. Congratulations! Your myPLTW account is now setup and ready for use.



The level of access you have in myPLTW will depend on what type of role was selected for you during the registration process. There are five roles in myPLTW: District Administrator, Principal, School Administrator, Student, and Teacher. Each role has different access within myPLTW and the myPLTW Learning Management System (LMS). Below is an overview of each role:

- **District Administrator** – This role can upload student rosters for any school in the district and enroll students in the myPLTW LMS.
- **Principal** – This role can upload student rosters, designate and remove School Administrator(s), make and approve roster changes, and download End-of-Course (EoC) assessments.
- **School Administrator** – This role can upload student rosters, make and approve roster changes, and retrieve EoC assessments. We recommend that School Administrators be in an administrative role, as they will have access to their school's PLTW student-level data and EoC assessment scores.
- **Student** – This role can access the myPLTW LMS and applicable course content based on his or her course enrollment.

- **Teacher** – This role can access the myPLTW LMS, enroll students in the myPLTW LMS for a course, submit class enrollment changes, register and manage EoC assessments, view students' current year EoC assessment scores, and access the Professional Learning Community (PLC).

### Roster and Enroll Your Students

One of the first actions you'll want to take in myPLTW is to roster your students. Rostering students is necessary to provide students with access to the myPLTW LMS and EoC assessments. It also provides PLTW with the ability to accurately report student-level demographic and performance data to state departments of education and EoC data to colleges and universities in support of preferential admissions and other student opportunities.

To roster students, please follow the instructions below:

1. Log in to [myPLTW](#).
2. Click "Upload Roster" on the menu bar. (Note: Only District Administrators, Principals, and School Administrators can roster students.)
3. Click the school you want to roster.
4. Read the [Student Roster Instructions](#) and use the [Student Roster Template](#) to prepare your file.
5. Once your student roster file is ready, browse to find the file on your computer. The file must be saved as a .CSV file to be uploaded.
6. Click "Submit".
7. Teachers are now able to enroll their students in the myPLTW Learning Management System (LMS).

After students are rostered, they need to be enrolled in the myPLTW LMS for their specific PLTW class(es). To enroll students in the myPLTW LMS, please follow the instructions below:

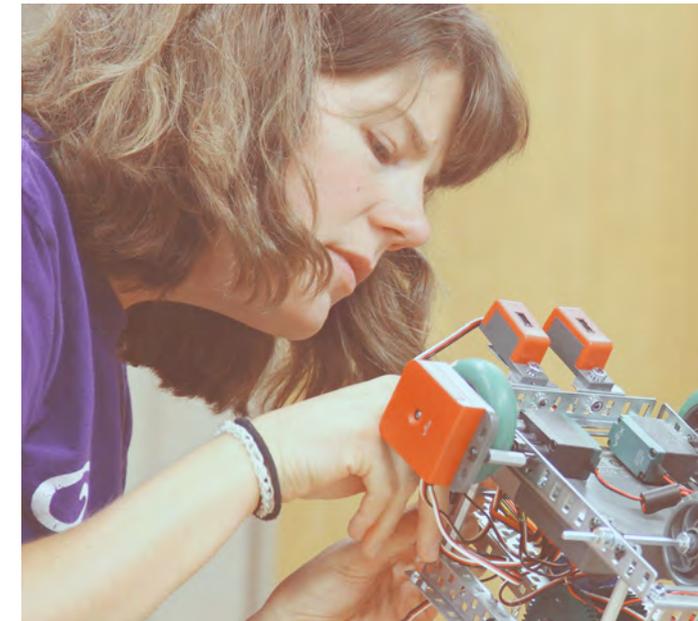
1. Click "Manage Classrooms" on the menu bar.
2. Click "View/Manage" next to the applicable course.
3. Click "Enroll Class in LMS".

### Access the myPLTW LMS

Within the myPLTW LMS, Teachers can access PLTW program curriculum, Professional Learning Communities (PLCs), and professional development courses. The myPLTW LMS also provides enrolled students with access to the student view of course curriculum.

To access your courses in the myPLTW LMS, please follow the instructions below:

1. Log in to [myPLTW](#).
2. Click "Access Courses" on the menu bar.
3. Click "Courses" in the myPLTW LMS menu bar. This will display a dropdown of your default or favorite list of courses. To see all of your courses or set-up your favorites, click "View All and Customize".
4. Click the applicable course.





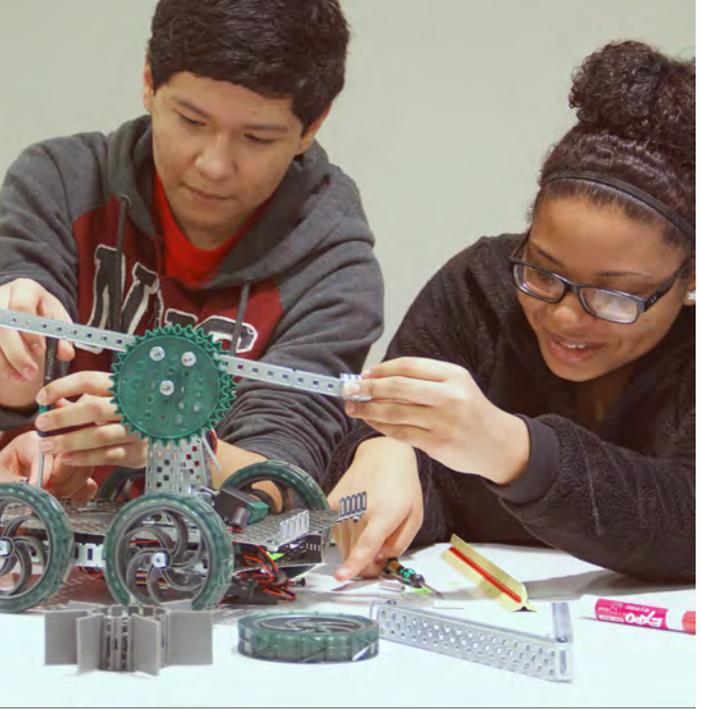
## Build Your PLTW Community

Creating a strong PLTW community means reaching beyond the PLTW classroom to connect students and educators with a broader network of supporters. A strong PLTW community reinforces student learning, creates opportunities for student recognition, and connects the program to the rest of the school, your community, local business and industry, and the economy.

Below are a number of ways you can build and grow your PLTW community.

- **Local Business Involvement** – Your program has the opportunity to put industry experience at students’ fingertips through local partnership teams, internships, mentorships, and more. [Download the PLTW Partnership Guide.](#)

- **Promoting Your Program** – Through media outreach and program promotion efforts, your school can stand out and gain recognition. [Download Promoting Your PLTW Program Resources.](#)
- **STEM Premier** – STEM Premier is an online platform that allows your students to showcase their STEM skills and connect with educators and employers. [Download How to Start a STEM Premier Profile.](#)
- **Student Organizations** – Your school can create more opportunities for students to explore their interests and apply their knowledge and skills through career-focused activities and competitions.
- **Applying PLTW Principles Across Classrooms** – Your school can maximize the value of your PLTW programs by extending PLTW’s Activity-, Project-, Problem-Based (APB) learning approach and principles across classrooms/courses.





**Need Help?**

PLTW team members will be with you every step of the way to support you and your PLTW program(s). If you need any assistance or have questions, please reach out to us!

PLTW Solution Center  
877.335.7589  
schoolsupport@pltw.org  
Monday – Friday from 7 a.m. to 11 p.m. ET





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Indianapolis, IN 46240

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