Automation and Robotics

(Gateway to Technology)

STEAM

Science, Technology, Engineering, Arts, Mathematics

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| **Gateway To Technology® Program (Automation and Robotics)**  |
| The PLTW® Gateway To Technology® program(GTT) is divided into two independent semester courses |
| developed for grades six through eight. GTT is taught in conjunction with a rigorous academic curriculum |
| and is designed to challenge and engage the natural curiosity of students. The program harnesses the |
| enthusiasm and energy of middle school students. The program focuses on showing, not telling, students |
| how to use engineering skills to solve everyday problems. Students won’t ask, "will I ever use this in |
| real life?”, because they will be applying their skills as they learn them. The primary focus is using applied  |
| math and science to build stronger math, science, and technology inquiry skills. Students will begin the program by learning about *What is Engineering?*, *Design Process* and then move into the *Automation and Robotics* portion of the program. **Course Outline:** **Introduction Unit - Lesson 1.1 What is Engineering?** **Lesson 1.1 What is Engineering?** **Understandings**1. An engineering notebook is used to record original ideas or designs and to document the design process related to an invention or innovation.
2. A portfolio is an organized collection of best works.
3. Science is the study of the natural world, while technology is the study of how humans develop new products to meet needs and wants.
4. Teams of people can accomplish more than one individual working alone.
5. Technological change is seen through inventions, innovations, and the evolution of technological artifacts, processes, and systems.
6. Technology can have positive and negative social, cultural, economical, political, and environmental consequences.
7. Engineers, designers, and engineering technologists are needed in high demand for the development of future technology to meet societal needs and wants.

**Knowledge and Skills***It is expected that students will:** Utilize standard procedures to use and maintain an engineering notebook.
* Use guidelines for developing and maintaining an engineering notebook to evaluate and select pieces of one’s own work for inclusion in a portfolio.
* Describe the relationship between science, technology, engineering, and math.
* Identify the differences between invention and innovation.
* Operate as an effective member of a team to complete an investigation.
* Describe engineering and explain how engineers participate in or contribute to the invention and innovation of products.
* Describe impacts that technology has had on society.

**Lesson 1.2 Design Process** **Understandings**1. Many different design processes are used to guide people in developing solutions to problems.
2. The design brief is a tool for defining the problem; it is an agreement between the engineer and client.
3. Engineers use design briefs to explain the problem, identify solution expectations, and establish project constraints.
4. Design teams use brainstorming techniques to generate large numbers of ideas in a short amount of time, striving for quantity, not quality.
5. A decision matrix is a tool used to compare solution ideas to the criteria so that you can select the best solution.

**Knowledge and Skills***It is expected that students will:** Describe the design process and how it is used to aid in problem solving.
* Describe the elements of design.
* Recognize design criteria and constraints.
* Describe the purpose and importance of working in a team.
* Use the design process to solve a technical problem.
* Apply the elements of design to the design process.
* Explain a design brief and apply the concept when using the design process.
* Operate effectively as a member of a team to complete a design project.
* Use a decision matrix to select the best solution to a design.

**Assignments:**[Add Assignment to Introduction Unit - Lesson 1.1 What is Engineering?](https://pltw.instructure.com/courses/179254/assignments) * [Activity 1.1.1 PLTW Gateway Dividers](https://pltw.instructure.com/courses/179254/assignments/2392816)
* [Activity 1.1.1.a Engineering Notebook Templates](https://pltw.instructure.com/courses/179254/assignments/2392817)
* [Activity 1.1.2 Introduction to Engineering](https://pltw.instructure.com/courses/179254/assignments/2392819)
* [Project 1.1.3 STEM Investigation](https://pltw.instructure.com/courses/179254/assignments/2392821)
* [Activity 1.1.4 What is Technology?](https://pltw.instructure.com/courses/179254/assignments/2392823)
* [Activity 1.1.5.a Engineering Careers - Scavenger Hunt](https://pltw.instructure.com/courses/179254/assignments/2392825)
* [Activity 1.1.5.b Engineering Careers - Interview](https://pltw.instructure.com/courses/179254/assignments/2392827)
* [Activity 1.1.5.c Engineering Careers - Brochure](https://pltw.instructure.com/courses/179254/assignments/2392828)
* [Activity 1.1.5.d Engineering Careers - Book](https://pltw.instructure.com/courses/179254/assignments/2392829)
* [Activity 1.1.5.e Engineering Careers - Skit](https://pltw.instructure.com/courses/179254/assignments/2392830)
* [Activity 1.1.5.f Engineering Careers - Online Magazine](https://pltw.instructure.com/courses/179254/assignments/2392831)
* [Activity 1.1.5.g Engineering Careers - Glog](https://pltw.instructure.com/courses/179254/assignments/2392832)
* [Activity 1.1.5.h Engineering Careers - Flowchart](https://pltw.instructure.com/courses/179254/assignments/2392833)

[Lesson 1.1 What Is Engineering - Key Terms](https://pltw.instructure.com/courses/179254/assignments/2392815) **Introduction Unit - Lesson 1.2 Design Process** [Add Assignment to Introduction Unit - Lesson 1.2 Design Process](https://pltw.instructure.com/courses/179254/assignments) * [Activity 1.2.2 Design Elements](https://pltw.instructure.com/courses/179254/assignments/2392836)
* [Activity 1.2.3 Furniture Design](https://pltw.instructure.com/courses/179254/assignments/2392837)
* [Activity 1.2.3.a Hobby Organizer Design](https://pltw.instructure.com/courses/179254/assignments/2392838)

[Lesson 1.2 Design Process - Key Terms](https://pltw.instructure.com/courses/179254/assignments/2392834) **What is Automation and Robotics?** **Understandings**1. Automation is the use of technology to ease human labor or to extend the mental or physical capabilities of humans.
2. Robotics is the specialized field of engineering and computer science that deals with the design, construction, and application of robots.
3. The use of automation and robotics affects humans in various ways, both positively and negatively, including their safety, comfort, choices, and attitudes about a technology’s development and use.
4. Automation and robotics have had an influence on society in the past and present and will influence society in the future.
5. Engineers, designers, and engineering technologists are in high demand for the development of future technology to meet societal needs and wants.

**Knowledge and Skills**It is expected that students will:* Describe the purpose of automation and robotics and its effect on society.
* Summarize ways that robots are used in today’s world and the impact of their use on society.
* Describe positive and negative effects of automation and robotics on humans in terms of safety and economics.
* Provide examples of STEM careers and the need for these professionals in our society.

**Lesson 2.2 Mechanical Systems** **Understandings**1. Energy is the capacity to do work; the use of mechanisms is necessary to transfer energy.
2. Engineers and technologists design mechanisms to change energy by transferring direction, speed, type of movement, and force or torque.
3. Mechanisms can be used individually, in pairs, or in systems.

**Knowledge and Skills***It is expected that students will:** Use ratios to solve mechanical advantage problems.
* Use numerical and algebraic expressions and equations to solve real-life problems, such as gear ratios.
* Use the characteristics of a specific mechanism to evaluate its purpose and applications.
* Apply knowledge of mechanisms to solve a unique problem for speed, torque, force, or type of motion.

**Lesson 2.3 Automated Systems****Understandings**1. Automated systems require minimal human intervention.
2. An open-loop system has no feedback path and requires human intervention, while a closed-loop system uses feedback.
3. Troubleshooting is a problem-solving method used to identify the cause of a malfunction in a technological system.
4. Comments do not change the way a robot behaves, but they do allow the programmer to remember the function that the code performs.
5. Invention is a process of turning ideas and imagination into devices and systems.
6. Some technological problems are best solved through experimentation.
7. Fluid power systems are categorized as either pneumatic, which uses gas, or hydraulic, which uses liquids. (FT Version)
8. Automated systems can be powered by alternative energy sources like solar and fuel cells. (FT Version)

**Knowledge and Skills***It is expected that students will:** Know the seven technological resources and how they are integrated into an open and closed loop system.
* Describe the purpose of pseudocode and comments within a computer program.
* Know how to use ratio reasoning to solve mechanical advantage problems.
* Design, build, wire, and program both open and closed loop systems.
* Use motors and sensors appropriately to solve robotic problems.
* Troubleshoot a malfunctioning system using a methodical approach.
* Experience fluid power by creating and troubleshooting a pneumatic device. (FT Version)
* Design, build, wire and program a system operated by alternative energy. (FT Version)
* Explain the roles and responsibilities of mechanical, electrical, and computer engineers who solve robotic problems.
* [Lesson 2.1 What is Automation and Robotics? - Overview](https://pltw.instructure.com/courses/133394/modules/items/3411335)
* [Lesson 2.1 What is Automation and Robotics? - Key Terms](https://pltw.instructure.com/courses/133394/modules/items/3411340)
* [Activity 2.1.1a Sandwich Algorithm](https://pltw.instructure.com/courses/133394/modules/items/3411343)
* [Activity 2.1.1b Fishertechnik Build](https://pltw.instructure.com/courses/133394/modules/items/3411347)
* [Activity 2.1.2 What Do We Use Robots For?](https://pltw.instructure.com/courses/133394/modules/items/3411353)
* [Activity 2.1.2a Understanding Robots](https://pltw.instructure.com/courses/133394/modules/items/3411357)
* [Lesson 2.1 What is Automation and Robotics? - Teacher Resources](https://pltw.instructure.com/courses/133394/modules/items/3411361)

**Unit 2 Automation and Robitics - Lesson 2.2 Mechanical Systems** * [Lesson 2.2 Mechanical Systems - Overview](https://pltw.instructure.com/courses/133394/modules/items/3411369)
* [Lesson 2.2 Mechanical Systems - Key Terms](https://pltw.instructure.com/courses/133394/modules/items/3411374)
* [Building with fischertechniks®](https://pltw.instructure.com/courses/133394/modules/items/3411378)
* [Activity 2.2.1 Observing Mechanisms](https://pltw.instructure.com/courses/133394/modules/items/3411381)
* [Activity 2.2.2 Mechanical Gears](https://pltw.instructure.com/courses/133394/modules/items/3411386)
* [Activity 2.2.2a Mechanical Gears Review](https://pltw.instructure.com/courses/133394/modules/items/3411388)
* [Project 2.2.3 Windmill Construction](https://pltw.instructure.com/courses/133394/modules/items/3411393)
* [Project 2.2.4 Pull Toy Construction](https://pltw.instructure.com/courses/133394/modules/items/3411397)
* [Project 2.2.5 Survival Challenge](https://pltw.instructure.com/courses/133394/modules/items/3411410)
* [Lesson 2.2 Mechanical Systems - Teacher Resources](https://pltw.instructure.com/courses/133394/modules/items/3411414)

**Unit 2 Automation and Robotics - Lesson 2.3 Automated Systems** * [Lesson 2.3 Automated Systems - Overview](https://pltw.instructure.com/courses/133394/modules/items/3411421)
* [Lesson 2.3 Automated Systems - Key Terms](https://pltw.instructure.com/courses/133394/modules/items/3411424)
* [Activity 2.3.1 Using Graphic Icons](https://pltw.instructure.com/courses/133394/modules/items/3411430)
* [Activity 2.3.1a “Beef” Up Your Technological Resources Understanding](https://pltw.instructure.com/courses/133394/modules/items/3411435)
* [Activity 2.3.2 fischertechnik® Interface Connections](https://pltw.instructure.com/courses/133394/modules/items/3411439)
* [Activity 2.3.2 Troubleshooting a fischertechnik® Model](https://pltw.instructure.com/courses/133394/modules/items/3411442)
* [Project 2.3.3 Automation Through Programming](https://pltw.instructure.com/courses/133394/modules/items/3411447)
* [Activity 2.3.4a Pneumatic System](https://pltw.instructure.com/courses/133394/modules/items/3411451)
* [Activity 2.3.4a Traffic Signal Alerts](https://pltw.instructure.com/courses/133394/modules/items/3411454)
* [Project 2.3.4 Fuel Cell User Guide](https://pltw.instructure.com/courses/133394/modules/items/3411458)
* [Project 2.3.5 Simulated Factory Assembly Line](https://pltw.instructure.com/courses/133394/modules/items/3411461)

[Lesson 2.3 Automated Systems - Teacher Resources](https://pltw.instructure.com/courses/133394/modules/items/3411466)Due to the nature of the class, some of the assignments above may not be assigned. The above is just a general outline. Please refer to my website from the Pau Wa Lu homepage for more information regarding assignments throughout the semester. |

I look forward to working with your student this year! Any questions, please feel free to contact me anytime.

Sincerely,

Allison Avery