CTE Workcell Automation – Letter Home

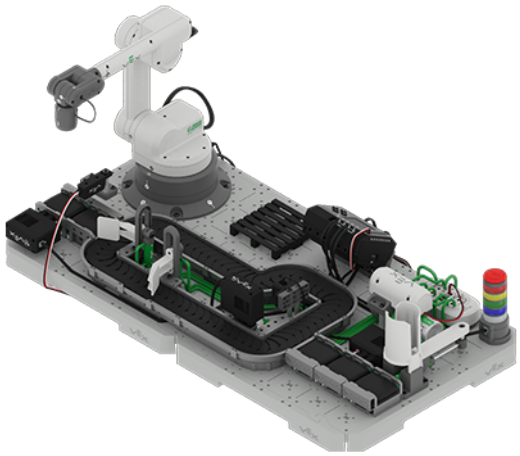
Support student learning at home

Your student is currently engaged in the VEX CTE Workcell course, Workcell Automation. In this course, students will build on what they learned in the previous course, as they explore the CTE Workcell through hands-on STEM learning in robotics and coding with real-world applications. Read and keep this Letter Home for an introduction to what your student will be doing and learning in the CTE course, so that you can support their learning and curiosity at home.

The CTE Workcell Automation Course and Industrial Connections

Factory automation has revolutionized how goods are manufactured and handled around the world. Central to this automation, is the concept of a workcell, an efficient arrangement of equipment and machinery designed to optimize production processes. Within a workcell, multiple systems, like conveyors, pneumatics, and robotic arms are integrated to enable the workcell to function efficiently and handle materials safely.

Throughout this course, students will dive deeper into the dynamic world of factory automation, exploring how robotic arms work together with conveyors, pneumatics, and sensors within a workcell. Through hands-on exploration and activities, students learn about how to build and code a workcell. Students are exposed to conveyor and pneumatic systems, sensors, and the computer science concepts needed to integrate a complete workcell to carry out tasks in real-world scenarios. They gain practical experience in not only the control of a workcell, but also the persistence, problem solving, collaboration, and creativity needed to take part in a career in industrial robotics, or any other field.



Sequence of the Course

Use this overview to give you an idea of what students will be doing and learning in each Unit of the course.

- **Unit 1 – Introduction to Workcells**
  - Students will set up the VEX CTE Workcell and their engineering notebook for the course. They will learn how to use the EXP Brain with the 6-Axis Robotic Arm.
- **Unit 2 – Workcell Safety**
  - Students will explore safety measures in industrial robotics with their CTE Workcell.
- **Unit 3 – Sorting by Color**
  - Students will add the Optical Sensor and learn about how to code the 6-Axis Arm to sort Disks by color.
- **Unit 4 – Material Transportation**
  - Students will add conveyors to the CTE Workcell to automate object movement. They will learn about how to code the motors to move a Disk from the loading zone to a pick up point.
- **Unit 5 – Understanding Pneumatics**
  - Students will learn about pneumatic systems, their components, and their industrial applications. They will build a Pneumatic Testbed to explore air flow and pneumatic circuits.
- **Unit 6 – Automated Sorting Challenge**
  - In this first open-ended challenge Unit, students will learn a three phrase approach to solving a real-world challenge. They will apply what they have learned to a product distribution scenario, in order to code the CTE Workcell to sort products to two different Loading Docks.
- **Unit 7 – Pallet Loading Challenge**

    - Students will build on their previous challenge experience to incorporate the 6-Axis Robotic Arm and Distance Sensor to sort products to three Loading Docks to fulfill a given Shipping Manifest.

- **Unit 8 – Optical Sorting Challenge**
    - In this third open-ended challenge, students will be challenged to sort products in any order. They will incorporate the Optical Sensor into the CTE Workcell to sort products by color to three different Loading Docks.

- **Capstone – Logistics Sorting Challenge**
    - Students will apply everything they have learned throughout the course to their biggest real-world open ended challenge yet! Students will be tasked with fulfilling a Shipping Manifest by sorting three types of products from two areas, going to three Loading Docks as quickly and accurately as possible.

What you can do at home:

Ask your students about what they are doing and learning with the CTE Workcell in class, and how they think that would be useful in a real world factory setting. The more opportunities students have to think and talk about what they are learning, and connect it to real world applications, the better they can reflect on their learning in class. This can also help spark interest in future career paths.

Engineering Notebooks in this Course

Students will be using an engineering notebook to create a comprehensive record of their learning throughout the course. Not only will they document what they did with the CTE Workcell, they will also be documenting their reflections, questions, discussions, problem solving strategies, and more. The goal of the engineering notebook is not only to document projects, but to help students better understand themselves as a learner.

Engineering notebooks are shared and discussed regularly between students and teachers, and are a core component of the student-centered assessment that is emphasized in the course structure.

What you can do at home:

Ask your student to share their notebook with you, and talk with them about what, how, and why they documented their learning in the way that they did. The more opportunities that students have to explain their thinking and verbalize their reasoning, the better they will understand the concepts at hand, and be able to reflect on their learning and documentation strategies as well.

Open-Ended Challenges in this Course

Once students reach Unit 6, they are put in the position to apply what they have learned from both courses to solve a series of open-ended challenges in a real-world factory automation context. Students work in teams as Automation Technicians, to fulfill Shipping Manifests by sorting products to various Loading Docks as accurately and quickly as possible. Each Unit challenge builds in complexity, and requires students to collaborate in a team to brainstorm, plan, and execute projects. Each team of students will address the challenge in their unique way, and will engage in productive struggle in order to effectively solve the challenge.

What you can do at home:

Talk to your student about the challenge, their team's strategy, and how they are persevering when faced with a struggle. Ask questions about why the team made certain decisions, what they learned from others in class, and how they are using what they've learned and done previously to help them here. Share an open-ended challenge that you've faced in life or at work, and talk with your student about your own approach, and how the thought processes they use to solve their challenge can help them in the future.

Collaboration with the CTE Workcell

Students will be working in groups to complete the Lessons, Activities, and Challenges of the course. They will have many opportunities for collaborative decision making, building communication skills, and taking on varied roles within the group. Being able to work together with others to solve a problem or accomplish a task is something that students will need to do in their future, no matter their career path. The collaboration skills and strategies that students learn throughout the course are also something that they will be documenting in their engineering notebooks.

What you can do at home:

Talk with your student about the ways in which collaboration is part of your adult life – whether it be at work, or at home. Helping students to connect their experiences in class to life outside of school can reinforce the importance of things like communication. Be open with your student, and share stories of positive communication experiences, as well as how you resolved moments of miscommunication.