

The Future of Work: Integrating Emerging and Cross-Cutting Technologies: Manufacturing and IT

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Preparing Technicians for the
FUTURE OF WORK
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CORD
*Leading Change
in Education* 

Project Goals



- 1.** Empower community colleges to prepare technicians for the work of the future.

- 2.** Promote regional collaboration between community colleges and industry to determine the technical demands of work of the future.

- 3.** Support ATE Regional Networks focused on technician education for the work of the future.

- 4.** Foster implementation of the cross-disciplinary STEM core to maximize impact on technician education

What's Happening?

- Nature of work changing at unprecedented speeds
- Technology advancements in machine learning, AI, IoT, and robotics eliminating some jobs, creating others
- Technicians sit at the center of much of this disruption
- Education must keep up
- Our students' career paths will evolve

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Future-proofing STEM Technicians



The Cross-Disciplinary STEM Core:

Skill Area 1: Data Knowledge and Analysis

Skill Area 2: Advanced Digital Literacy

Skill Area 3: Business Knowledge and

Processes

**By Integrating the Cross-Disciplinary STEM Core
into Technical Programs**

A Framework for a Cross-Disciplinary STEM Core

Preparing Technicians
for the Future of Work

A Framework for a Cross-Disciplinary STEM Core



Preparing Technicians for the
FUTURE OF WORK



DATA KNOWLEDGE AND ANALYSIS

Manipulating and interpreting data to resolve issues and using Excel and other common software proficiently to accomplish tasks

- Analytics tools
- Computational thinking
- Data analysis
- Data backup and restoration
- Databases
- Data fluency
- Data life cycle
- Data management
- Data modeling
- Data storage
- Data visualization
- Query languages
- Spreadsheets
- Statistics

ADVANCED DIGITAL LITERACY

Understanding digital communications and networking, cybersecurity, machine learning, sensors, programming, and robotics at a higher than introductory level

- Artificial intelligence/machine learning
- Automation/robotics
- Basic programming
- Cloud literacy
- Digital fluency
- Digital twins
- Edge computing
- Function block diagram programming
- Human-Machine Interface (HMI)
- Internet of Things (IoT)
- Network architecture
- Network communication
- Security controls

BUSINESS KNOWLEDGE AND PROCESSES

Understanding the value chain and business practices of an enterprise and applying principles of ethical adoption of new technologies

- Business cycles
- Blockchain
- Communication
- Continuous process improvement
- Customer/stakeholder analysis
- Entrepreneurship
- Ethics
- Lean processes
- Supply chains
- Market trends
- Overall Equipment Efficiency (OEE)
- Return on Investment (ROI)
- Risk management
- Supply and demand
- Vertical and horizontal integration

Welcome Leah and Diane



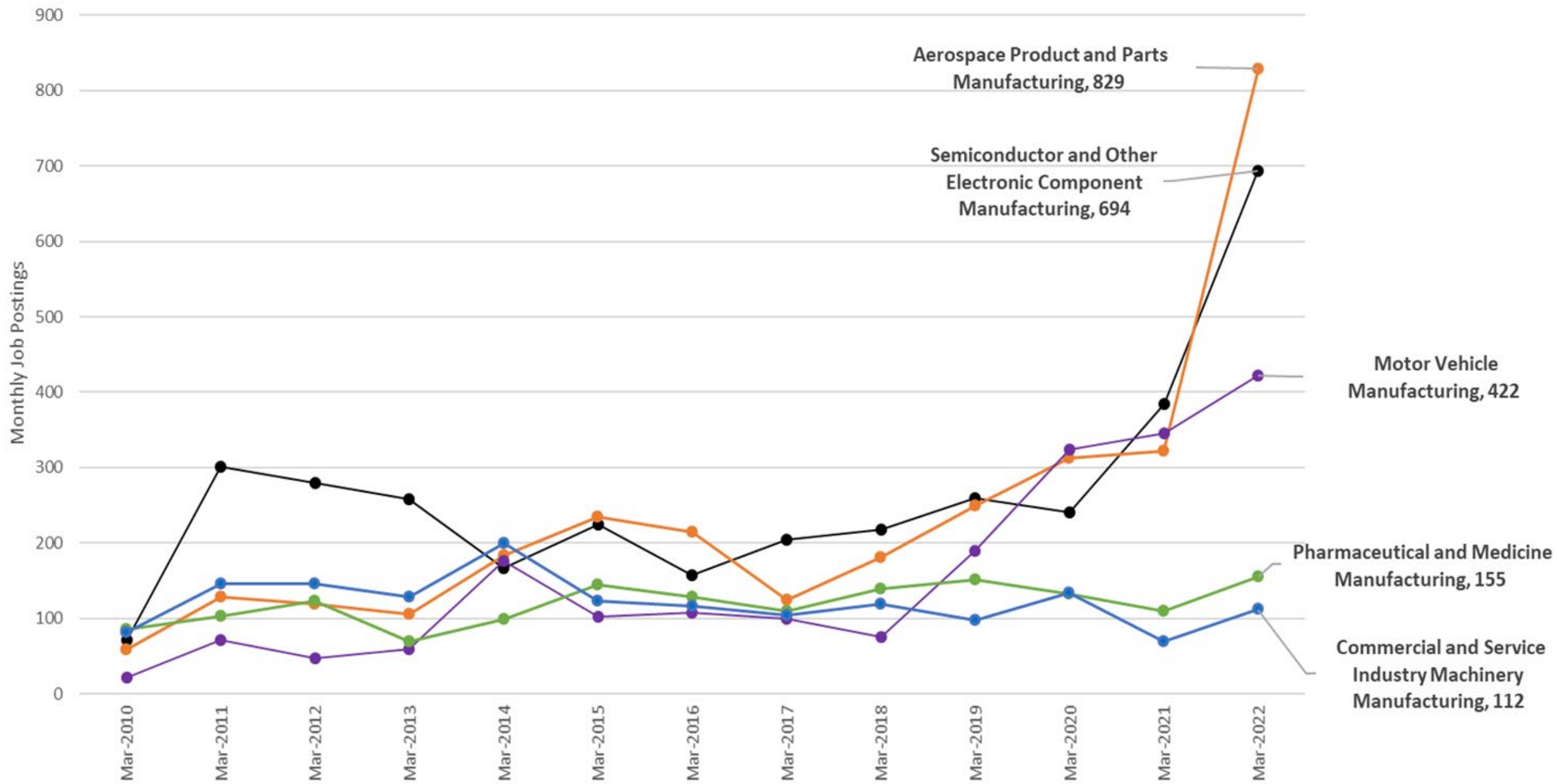
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MARICOPA
COMMUNITY COLLEGES

The Maricopa County Community College District (MCCCD) is an EEO/AA institution and an equal opportunity employer of protected veterans and individuals with disabilities. All qualified applicants will receive consideration for employment without regard to race, color, religion, sex, sexual orientation, gender identity, age, or national origin. A lack of English language skills will not be a barrier to admission and participation in the career and technical education programs of the District. The Maricopa County Community College District does not discriminate on the basis of race, color, national origin, sex, disability or age in its programs or activities. For Title IX/504 concerns, call the following number to reach the appointed coordinator: (480) 731-8496. For additional information, as well as a listing of all coordinators within the Maricopa College system, visit <http://www.maricopa.edu/non-discrimination>.

HOW WE ARE MAKING IT HAPPEN: Quick Start Partnership Design

- ✓ **Acceleration MODEL** for targeting scope scale designing 10-day credit courses belonging to an existing **pathway earning college credit, industry certification and leads to a degree pathway.**
- ✓ **Recruited Adjunct Faculty** recruited 49 qualified 20 instructors trained and teaching currently
- ✓ **Joint Marketing Systemized** - college teams use landing pages, QR codes, measure hits, pretesting for readiness, constant contact
- ✓ **Industry Hiring Recruiters** connect at hiring Fairs monthly
- ✓ **DEI is a Priority** - increasing the # of women technicians as well as overall **diversity and equity (measured)**
- ✓ **State Partnership** - Economic Development - Industry and Engagement



Student Data - Semiconductors

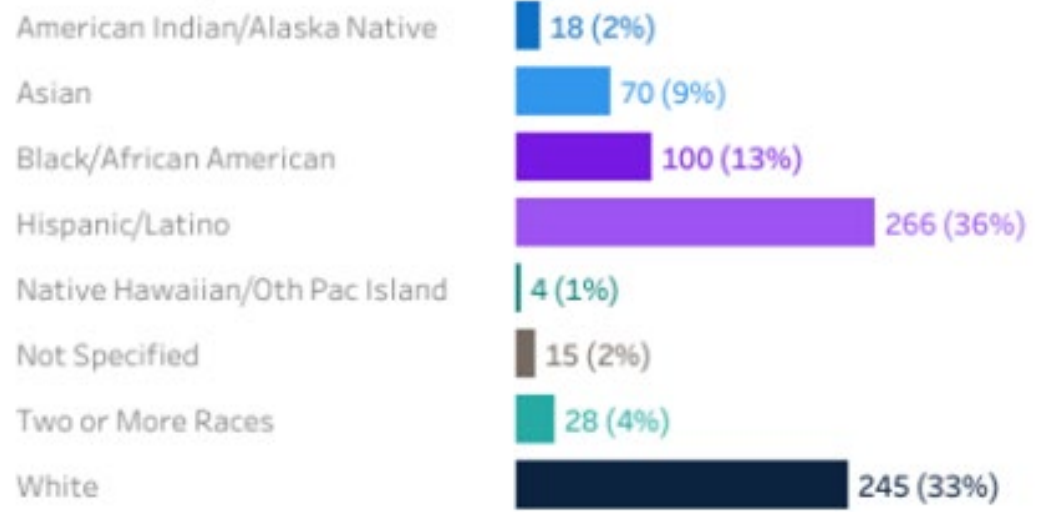
(June 2022 – October 2023)

- Certifications to Date: **712**
- Number of Classes: **69**
- Number of Students: **892**
- First Generation return: **62**

- Students of Color: **65%**
- Female Students: **32%**
- Age Group 18-29: **44%**
- First Generation: **50%**



Race & Ethnicity



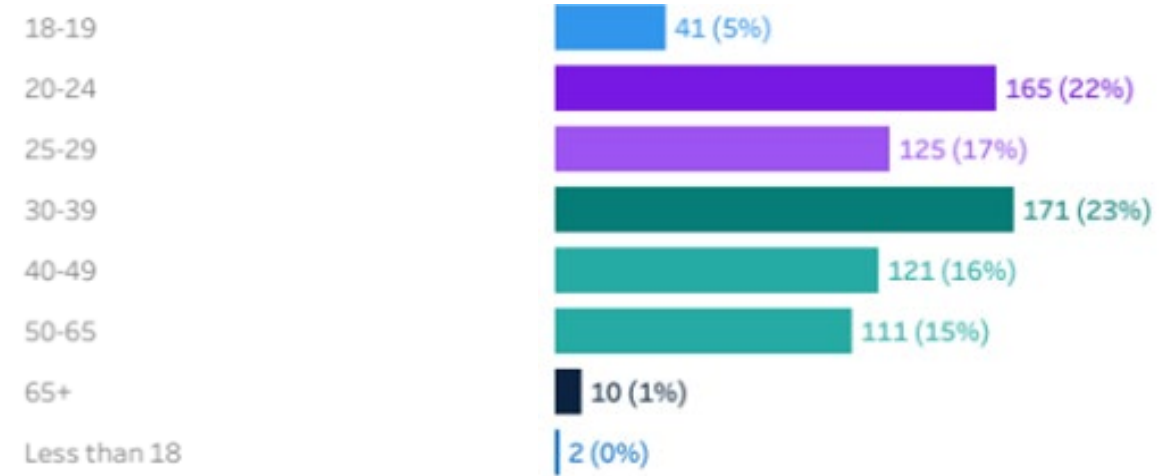
Gender



Max First Generation



Age Groups





How Technician IT Fundamentals Started

- History
- Professional Skills
- Existing courses
- Pilot
- Partners
- Job Descriptions
- Arizona Career Readiness Credential-Digital Literacy Exam-Evolved into the CompTIA ITF+ Exam with a MCCCD Micro-certification Badge



Technician IT Fundamentals Program Curriculum

Recall Computer
hardware
components-basic
review

Navigate
Windows and
Manage files
and folders



Technician IT Fundamentals Program Curriculum

Learn word processing software, text-editing, and the basic formatting of documents.

Learn PowerPoint software to produce professional-quality presentation visuals.



Technician IT Fundamentals Program Curriculum

Learn computer spreadsheet skills for solving business problems using Excel, including calculations, forecasting, and projections.

Identify and recognize different types of databases and data analytic tools.

Questions?



MARICOPA
COMMUNITY COLLEGES



At the Project Website: Preparingtechnicians.org

Tools and Resources to Help You Take Action

- Read and share *A Framework for a Cross-Disciplinary STEM Core*
- Download, share and implement cross-disciplinary instructional cards in your class
- Listen to podcasts featuring cutting-edge industry interviews
- Share recorded webinars

Cross-Disciplinary Instructional Cards

Data Knowledge and Analysis

Manipulating and interpreting data to resolve issues and using Excel and other common software proficiently to accomplish tasks

DATA KNOWLEDGE AND ANALYSIS
Data Visualization

For Students

What is Data Visualization?
Data visualization represents information in the form of a chart, diagram, picture, or infographic so that the data can be quickly and easily understood. Technicians use data visualization software to create graphics that communicate complex and relational information to a variety of audiences.

Vocabulary

- Dataset** - a collection of data, often organized in a spreadsheet or database
- Chart** - a graphic representation of data, examples are charts, pie charts, histograms, line graphs for example
- Scale** - marks on a visualization that indicate the range of data values presented. A scale on a graph reflects the magnitude of the data presented.

Common Types of Data Visualization

- A pie chart uses "pie slices" to show relative sizes of data.
- A histogram uses bars of different heights to group data into ranges.
- A scatter plot uses points plotted on an XY axis to show the relationship between two sets of data.

How will a technician use data visualization?
Evan Garcia is a technician for Green Mountain Power Company. He is responsible for tracking increased system outages over time across a metropolitan network, collects outage statistics, including system logs, environmental information, and helps to determine the cause. Evan stores the data in an Excel workbook, then imports data into SAP, Tableau, or MS Power BI visualization tools and creates a dashboard to present to management. The data dashboard provides an interactive geographical heat map showing outage details and other graphical representations of his data analysis of the event. The heat map allows management to make real time decisions and troubleshoot problems.

A heat map uses a spectrum to color code spatial data values by color.




Instructional Activity Cards:

- Data Visualization
- Data Literacy/Fluency
- Spreadsheets
- Analytics Tools

Advanced Digital Literacy

Understanding digital communications and networking, cybersecurity, machine learning, sensors, programming, and robotics at a higher than introductory level

Advanced Digital Literacy
Network Communications - Internet of Things (IoT)

For Students

What is the Internet of Things (IoT) and how is it related to network communications?
The Internet of Things (IoT) consists of physical devices connected to the network. IoT devices are a combination of sensors, software, and electronics that connect to a central location locally in the cloud. They are often connected through a wireless network through which they communicate with one another and feed information to a user's mobile device or computer. Through the device, the user can monitor or control a process through a central point or dashboard. An example is the human-machine interface, internet-connected dashboard, thermostat, weather systems and wearable fitness trackers are everyday examples of IoT devices. In industry, a variety of sensors monitoring quality and machine operational parameters for preventative maintenance.

Vocabulary

- Smart sensors** - devices that measure and process data before sending to a centralized source; flow sensors used to measure water and rainfall data; smart meters, as an example
- Cloud computing** - delivery and storage of data over the internet rather than on-site; Google's gmail is an example.
- Information security** - processes used to protect information from unauthorized access, modification, or destruction; helping someone only to access devices and content is an example.

How will technicians use network communications and IoT technologies?
Network Communication Technicians familiar with IoT technologies will install, monitor, and maintain the IoT devices and the network's communication software that connects them to ensure proper operation. This includes tasks such as installing software updates, developing procedures to detect and prevent system logging, testing the network for malware, and troubleshooting system malfunctions. Their job often requires creative problem solving, as in this example:
A company that manages large parking garages wanted to reduce the time its customers spent parking for more parking spots. Some drivers spent several minutes locating up and down multiple floors to find an open parking spot. The desired system means for open parking spots are also a benefit for other uses and applications. A network technician is engaged to investigate a solution. After reviewing several options, the network technician decided to implement an IoT solution that includes sensors, apps, and a mobile app. IoT sensors were installed to monitor the status of each parking spot. The status of each parking spot was sent to a centralized computer. If a spot was available, signs throughout the garage would provide direction to the exact location on the garage floor in the same parking spot. The status of each parking spot was also available on a mobile app for length how before entering the garage how many spots were available and on what floor. This IoT solution reduced customer wait times, increased safety, and increased parking garage profits.



Instructional Activity Cards:

- Network Communications – Internet of Things
- Automation/Robotics/HMI
- Basic Programming-Python
- Digital Twins
- Network Architecture

Business Knowledge and Processes

Understanding the value chain and business practices of an enterprise and applying principles of ethical adoption of new technologies

Business Knowledge & Processes
ENTREPRENEURSHIP

Student Resource

What is Entrepreneurship?
Entrepreneurship is the concept of developing and owning a new business for profit, involving creating a company and driving the enterprise by selling "how can we improve this process?" as an example. Entrepreneurship involves finding, creating, and solving problems or opportunities. It involves taking care after that starts potential new products, services or processes.

Vocabulary

- Entrepreneur** - the individual who starts a new business venture. Typically, the individual who takes on most of the risk and develops the business concept.
- Workforce** - business enterprise in which the expectation of gain is accompanied by the risk of loss or failure.
- Capital** - the wealth or assets available to invest in a business.
- Business Model** - a description of how a business will be able to create and deliver value and become profitable.
- Market Research** - research data that helps demonstrate market potential for a business venture.
- Intellectual Property** - rights or inventions that are the result of creativity to which one has rights and can apply for a patent, copyright, or trademark.

How will an entrepreneurial mindset be used in the workplace?
An industry 4.0 technician of tomorrow needs creative entrepreneurial thinking as a new, marketable skill. John Graham is an industrial technician at Advanced Auto Safety Labs and he has been experiencing several customer complaints regarding repair times. Using an entrepreneurial mindset, John identified the problem and then researched possible solutions and their relative projections. He asked questions like: How much is customer satisfaction and repair speed worth and how much time and money can be saved through more accurate diagnosis and efficient repair? He then researched the equipment that a potential solution he has researched that will provide better customer service, shorter wait times, and faster service by the technicians, resulting in higher profits for the business.
In another example, Cassi Sanders is a robotics technician at Cooper Biotech, an Automated Filling and Packaging company. Over the last several days, a robot gripper had been dropping every fourth bottle out. The fault affected everything from the line, to the point at which several boxes dropped in a customer warehouse. This is clearly not an acceptable business practice. Cassi applied troubleshooting skills to



Instructional Activity Cards:

- Entrepreneurship
- Communication
- Lean Processes
- Supply and Demand

Podcasts



Episode 38: Technicians in the New Blue Economy

Podcast Guest: Justin Manley,
President of Just Innovation, Inc.
April 2022 |

[Read More »](#)



Episode 37: Incorporating the Internet of Things

Podcast Guests: Kristine
Christensen, Director of Faculty
Development, Professor of MIS,
Moraine

[Read More »](#)



Episode 36: Supply Chain Automation In Transition

Podcast Guest: Phil Gilkes, Regional
Maintenance Manager, Dollar Tree
Distribution Centers February 2022

[Read More »](#)

What Should Educators Know and Do about Preparing Technicians for the Future of Work?

Podcast Interviews Provide Direction

www.preparingtechnicians.org/podcasts

- i. **Podcasts: Automation, Robotics, and Advanced Manufacturing**
- ii. **Podcasts: Digital Skills, Digital Mastery. Digital Twins, Simulation**
- iii. **Podcasts: Industry, Factory, and Education Trends**
- iv. **Podcasts: New Skills, New Generations of Students**

- i. **Podcasts: Automation, Robotics, and Advanced Manufacturing**

AUTOMATION, ROBOTICS, AND ADVANCED MANUFACTURING

Topic and Episode(s)	Discovery	Recommended Action
1. A Robot for Every Technician? PC13 and PC22	A robot for every technician is an emerging trend in the workplace.	Ask yourself if it is possible for you to consider something similar in your education and training space? A robot (or an automated system) for every student, in every learning situation?

Recordings of This Webinar Series



1. Preparing Technicians Using the Cross-Disciplinary STEM Core
2. Professional Development and Instructional Resources
3. Future of Work: Integrating Emerging Technologies

<https://www.preparingtechnicians.org/webinars/>