Prepare your students for success in Industry 4.0

Industry 4.0 Career Pathways Program

INDUSTRY 4.0 THEMES

LJ CREATE™
Learning for life

Data and Analytics

Sensors and Control

Computation

Energy Technology

Materials

Industry 4.0 Career Pathways Program

Industry 4.0 Pathways

Prepare your students for success in Industry 4.0

Industry 4.0 is the name given for the ongoing revolution and innovation in the automation of industry, using smart technologies. Industry 4.0 concepts can be grouped into four key areas:

- Cyber-Physical Systems
- Internet of Things (IoT)
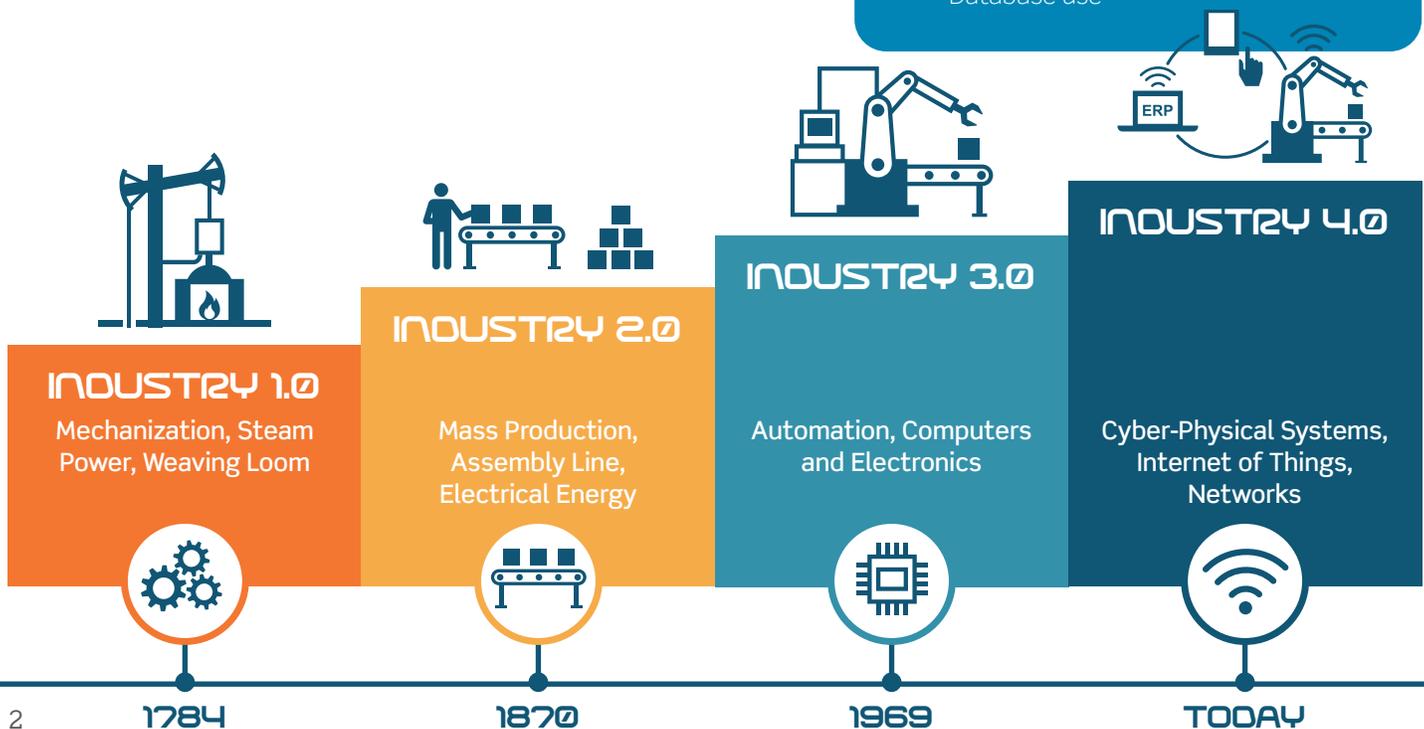- Cloud Computing
- AI and Cognitive Computing

Implementing Industry 4.0 ideologies can have many benefits for industry, including:
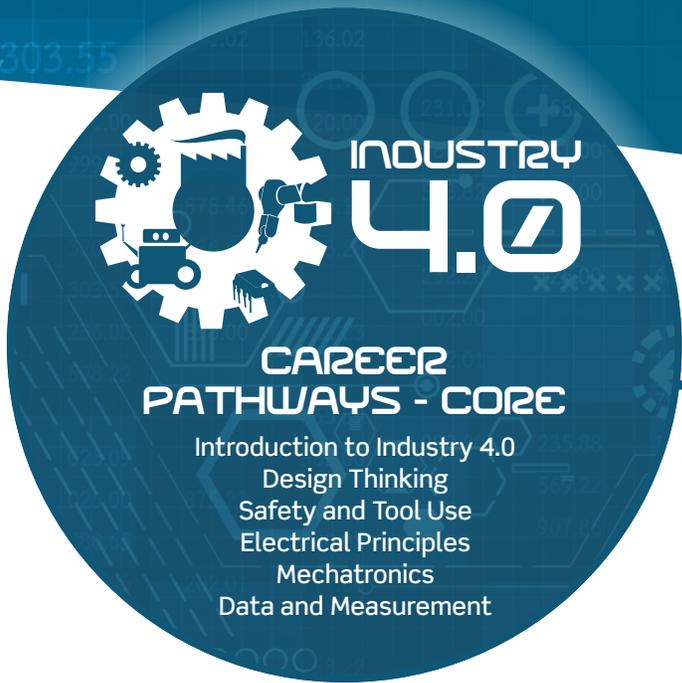
- Improving productivity and efficiency
- Promoting collaborative working
- Offering greater flexibility and agility
- Reducing operating costs

The aim of our program is to help students prepare for a career in a range of industries where Industry 4.0 skills are commonly used and increasingly required.

SKILLS/KNOWLEDGE REQUIRED FOR INDUSTRY 4.0 CAREERS INCLUDE:

- Industrial Skills
  - Safety
  - Quality systems
- Industrial Equipment
  - Fluid power
  - Robotics
- Smart Sensors and Devices
  - Sensors and smart sensors
  - Data collection
- Control Systems
  - Industrial control and PLCs
  - Motor control
- Connectivity and Networking
  - Computer networks
  - Wireless communication
- Data Analytics
  - Statistical analysis
  - Database use

INDUSTRY 1.0
Mechanization, Steam Power, Weaving Loom

1784

INDUSTRY 2.0
Mass Production, Assembly Line, Electrical Energy

1870

INDUSTRY 3.0
Automation, Computers and Electronics

1969

INDUSTRY 4.0
Cyber-Physical Systems, Internet of Things, Networks

TODAY

INDUSTRY 4.0

CAREER PATHWAYS - CORE

Introduction to Industry 4.0
Design Thinking
Safety and Tool Use
Electrical Principles
Mechatronics
Data and Measurement

Flexible structure - Students study a Core 45 hour block and then explore Industry 4.0 concepts in specific sectors.
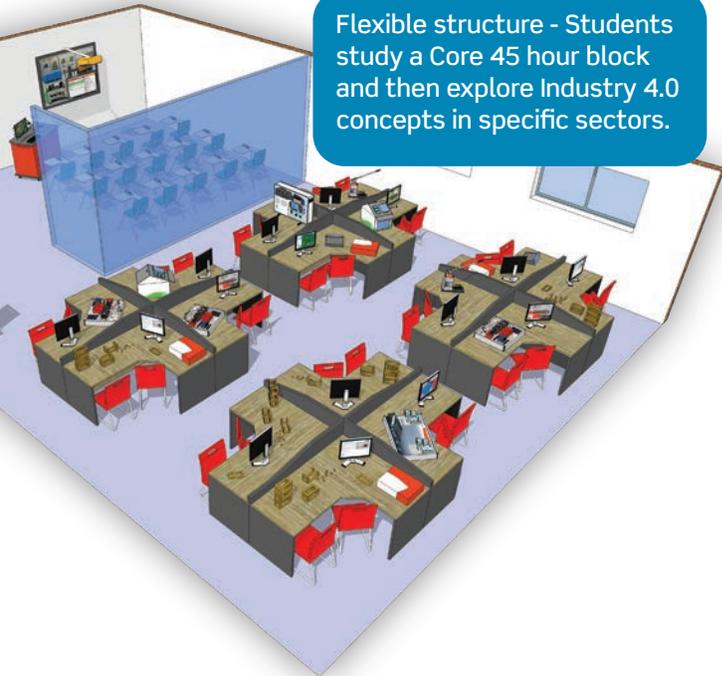
Give students a foundation in Industry 4.0 and STEM concepts

The Industry 4.0 program is designed to give students a foundation in how **Industry 4.0** and **STEM** concepts are applied in career pathways and then develop their knowledge and skills in specific industry sectors:

- Manufacturing
- Construction
- Biotechnology and Healthcare
- Information Technology
- Logistics
- Transportation
- Agriculture

CONSTRUCTION
- Construction Technology
- Building Technology
- Electronic Systems
- Electrical Technology
- Energy Technology

HEALTH & BIOMEDICAL
- Biomedical Technology
- Biochemistry and Food
- Health Science
- Human Health

INFORMATION TECHNOLOGY
- Computer Science
- Communications Technology
- Programming Robots
- Working with IT

MANUFACTURING
- Manufacturing Technology
- Machine Tools
- Rapid Manufacturing
- Industrial Robotics

LOGISTICS & SUPPLY CHAIN
- Mobile Robotics
- Introduction to Logistics and Warehousing
- Industrial Control

TRANSPORTATION
- Transportation Technology
- Introduction to Automotive Systems
- Hybrid and Electric Vehicles

AGRICULTURE
- Agricultural Technology
- Agricultural Science
- Natural Resources

➡ Project-Based Learning

Our program is packed full of design projects

A large part of the Industry 4.0 Career Pathways Program is **project-based**. Students work on projects as part of a multidisciplinary team to produce **solutions to real-world problems**.

The project-based nature of the program gives students the opportunity to learn, develop and apply academic skills and knowledge while they develop "**21st Century Skills**" such as critical thinking and problem solving, communication, collaboration, and creativity.

Preparation

Use your 3D printers for real-world design projects

Knowledge Lessons

Research, Investigation, and Modeling

DESIGN PROJECT

(MANUFACTURING)

Teamwork, Critical Thinking, and Problem Solving

Assessments

Computational Thinking

MATH - ELA - SCIENCE

Integrated Academic Support

21st Century Skills

Aligned with Academic Standards
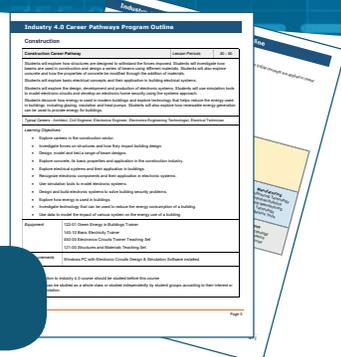
Career Pathways

Career readiness instruction

Each course provides instruction for advanced CTE certification courses, and career readiness - covering pathways such as:

- Agriculture, Food, and Natural Resources
- Architecture and Construction
- Business, Management, and Administration
- Health Science
- Information Technology
- Manufacturing

- Marketing, Sales, and Service
- Science, Technology, Engineering, and Mathematics

Courses Overview

Create your Industry 4.0 career pathways program

The Industry 4.0 Career Pathways Program includes **8 project-based courses**. An outline of each course is included in the Program Guide, containing:

- A description of the course
- Equipment requirements
- Support notes
- Typical careers
- Learning objectives
- Lessons

Each course contains:

- A presentation to identify relevant career pathways
- A set of lessons including theory presentations, hands-on practical activities, and investigations

The **Core Curriculum** course should be **studied first** - the remaining courses can be studied in any order. Required equipment is shown in the following table.

| COURSE	EQUIPMENT
Industry 4.0 Career Pathways Core	Engineering Construction Kit (220-02)
	Basic Electricity Trainer (140-10)
	Measurement Kit (511-08)
	Wireless Smart Sensors: Force Accelerometer (521-02), Light Gate (521-04), Motion (521-07), Sound (521-08)
	Physics Apparatus Kit (511-01)
	3D Printer
Construction	Structures and Materials Teaching Set (121-00)
	Green Energy in Buildings Trainer (122-01)
	Electronic Circuits Trainer Teaching Set (450-00)
	Basic Electricity Trainer (140-10)
Health and Biomedical Technology	Engineering Construction Kit (220-02)
	Biomedical Technology Kit (230-01)
	Human Biology Kit (510-03)
	Wireless Heart Rate Smart Sensor (521-03)
	Biology Apparatus Kit (510-01)
Information Technology	Engineering Construction Kit (220-02)
	Educational Robotics Invention Kit - ERIK (250-02)
	Electronic Communications Trainer (200-01)
Manufacturing	Injection Molding Trainer (350-01)
	Machine Tools Class Pack (506-50)
	Engineering Construction Kit (220-02)
	3D Printer - Capable of Printing ABS
Logistics and Supply Chain	Engineering Construction Kit (220-02)
	Industrial Control Trainer (290-01)
Transportation	Engineering Construction Kit (220-02)
	Displays and Accessories Systems Panel Trainer (752-01)
Agriculture	Sustainable Energy Production Student Resource Pack (100-02)
	Engineering Construction Kit (220-02)
	Earth Science Apparatus Kit (513-01)

Displays and Accessories Systems Trainer

Injection Molding Trainer

Electronic Communications Trainer

Engineering Construction Kit

Industrial Control Trainer

Machine Tools Class Pack

Physics Apparatus Kit
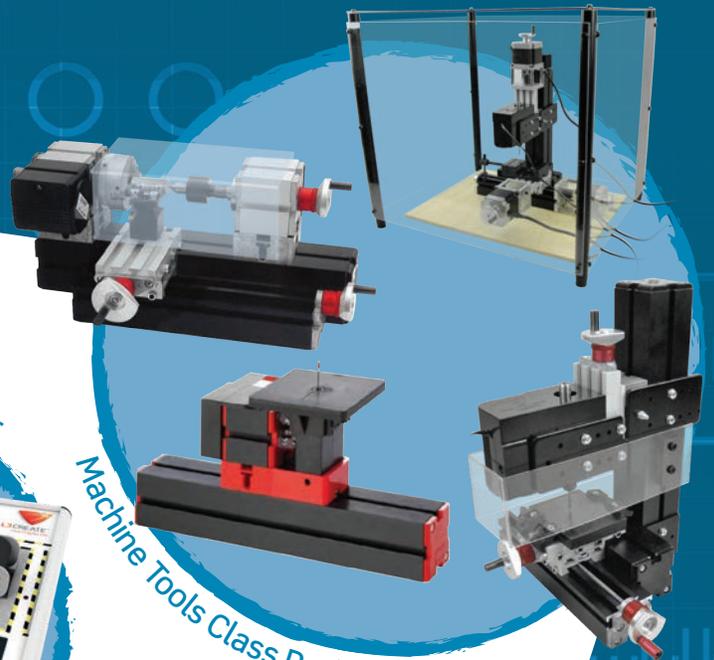
Structures and Materials Teaching Set

Biomedical Technology Kit

Electronic Circuits Trainer Teaching Set

Sustainable Energy Production Student Resource Pack

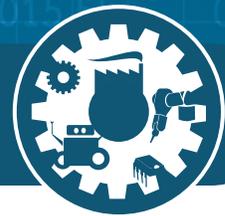Educational Robotics Invention Kit - ERIK

Green Energy in Buildings Trainer

Wireless Smart Sensors

Basic Electricity Trainer

INDUSTRY 4.0 CAREER PATHWAYS - CORE (40-50 LESSONS)

This 45 hour course introduces students to the **development of the Industry 4.0 concept**, its development and impact on many industrial sectors. Students are introduced to the central themes of Industry 4.0 with a core focus on Sensors and Control, Data and Analytics, Energy Technology, and Materials.

Learning Objectives

- Explore the Smart Factory/Industry 4.0 concept and its application across career sectors
- Develop reading, writing, and presentation skills
- Explore and use the design process as a method for solving engineering problems
- Recognize basic mechanical principles and machines - such as gears and levers
- Identify the basic principles and applications of fluid power systems
- Recognize basic electrical terminology and measure current/voltage in an electrical circuit
- Use sensors and data capture technology to collect data and analyze systems
- Determine current, voltage, resistance and power by measurement and calculation
- Apply engineering principles to design a microprocessor-controlled mechatronic system

Equipment

- Wireless Smart Sensors: Force Accelerometer (521-02), Light Gate (521-04), Motion (521-07), Sound (521-08)
- Measurement Kit (511-08)
- Physics Apparatus Kit (511-01)
- Basic Electricity Trainer (140-10)
- Engineering Construction Kit (220-02)
- 3D Printer

Typical Careers

Robotics Engineer, Industrial Maintenance Technician, Automation Specialist, Industrial Production Manager
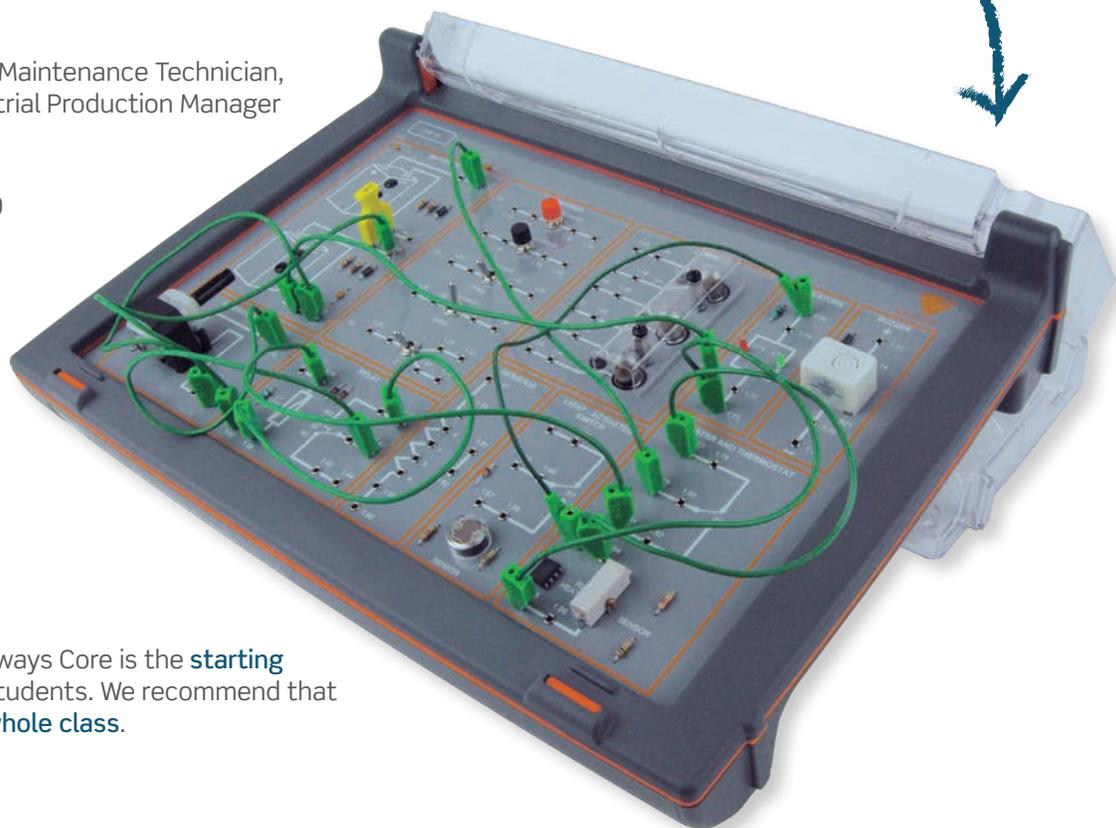
Lessons

- Introduction to Industry 4.0
- Tools and Safety
- Data and Measurement
- Engineering Design
- Electrical Systems
- Mechanical Systems
- 3D Printing

Design Projects

- Electric Motor Control
- Fairground Ride

Notes

The Industry 4.0 Career Pathways Core is the **starting place in the program** for all students. We recommend that this course be **studied as a whole class**.

CONSTRUCTION (40-50 LESSONS)

In this course students will investigate how beams are used in construction and design a series of beams using different materials. Students will use simulation tools to model electronic circuits and develop an electronic home security system. Renewable energy generation, and energy use in modern buildings is also explored.

Learning Objectives

- Explore careers in the construction sector
- Investigate forces on structures and how they impact building design
- Design, model, and test a range of beam designs
- Explore concrete, its basic properties, and application in the construction industry
- Explore electrical systems and their application in buildings
- Recognize electronic components and their application in electronic systems
- Use simulation tools to model electronic systems
- Design and build electronic systems to solve building security problems
- Explore how energy is used in buildings
- Investigate technology that can be used to reduce the energy consumption of a building
- Use data to model the impact of various systems on the energy use of a building

Typical Careers

Architect, Civil Engineer, Electronics Engineer, Electronics Engineering Technologist, Electrical Technician
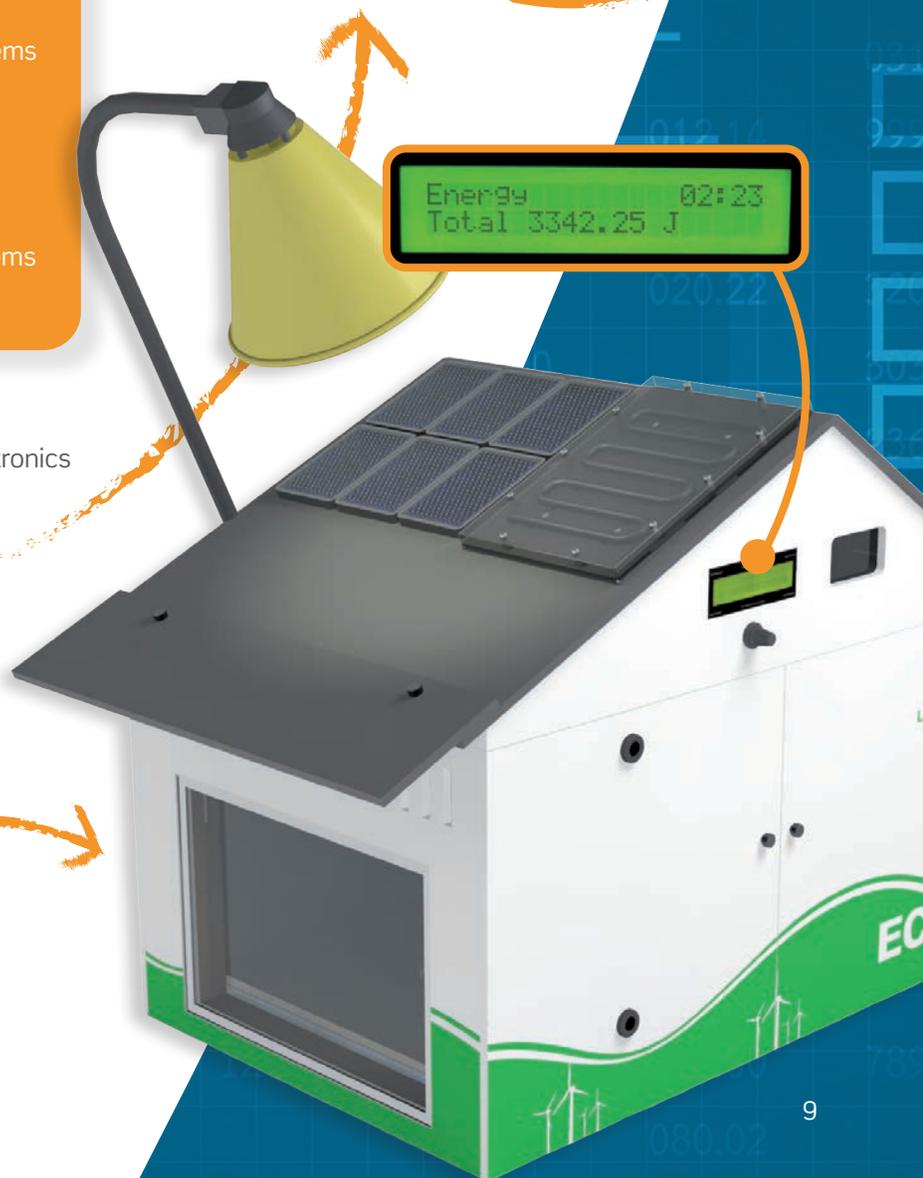
Lessons

- Introduction - Careers: Construction Technology
- Construction Technology
- Energy Systems
- Electrical Systems
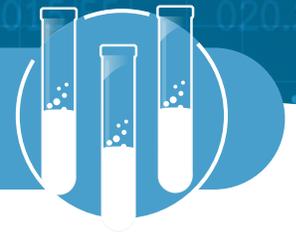- Electronic Systems

Design Project

- Bridge Design

Equipment

- Green Energy in Buildings Trainer (122-01)
- Structures and Materials Teaching Set (121-00)
- Basic Electricity Trainer (140-10)
- Electronic Circuits Trainer Teaching Set (450-00)

HEALTH AND BIOMEDICAL TECHNOLOGY (40-50 LESSONS)

This course explores the impact of medical advances on society, such as sanitation and vaccination. Students will investigate genetic engineering and medical scanning as examples of biomedical technology. The basic principles of health science, and the major systems of the human body are also covered on this course.

Learning Objectives

- Explore careers in the health sector
- Identify the impact of medical advances such as sanitation and vaccination
- Recognize the principles and application of genetic engineering
- Explore medical scanning technology
- Identify the structure and function of the major systems of the human body
- Explore data logging technology and use it to investigate the circulation system
- Recognize cell types and structure, and use a microscope to explore cells
- Recognize the relationship of genetics and environment to human health
- Identify the structure/function of biomolecules
- Use food tests to determine food content
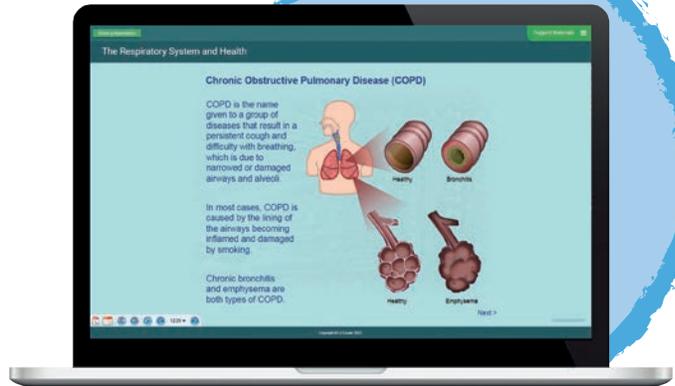
Typical Careers

Radiation Therapist, Medical Electronics Technician, Medicine, Radiologic Technologist

Lessons

- Introduction - Careers: Health and Biomedical
- Biomedical Technology
- Cells and Microbiology
- Biochemistry
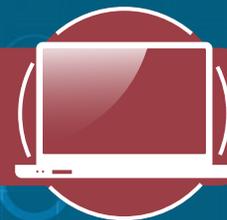- Human Anatomy and Health

Design Project

- Model Scanner

Equipment

- Engineering Construction Kit (220-02)
- Biomedical Technology Kit (230-01)
- Human Biology Kit (510-03)
- Wireless Heart Rate Smart Sensor (521-03)
- Biology Apparatus Kit (510-01)

NEW PROJECT

INFORMATION TECHNOLOGY (40-50 LESSONS)

This course explores techniques for algorithm development, including the use of **flowchart design** and pseudo code. Students will develop and test programs to control a range of robotic systems. They also investigate security and privacy considerations when using IT in a workplace environment.

Learning Objectives

- Explore careers in the IT sector
- Use an algorithm problem-solving process to develop solutions to engineering problems
- Develop algorithms that use sensor inputs and physical outputs
- Recognize the use of control structures to design hardware control systems
- Use control structures in the design of programs for robotic systems
- Design and program solutions to a range of robotic systems
- Identify IT safety and security considerations
- Recognize the principles of computer networks and how they are used in industry
- Explore the basic concepts (and terminology) of modern communications technology
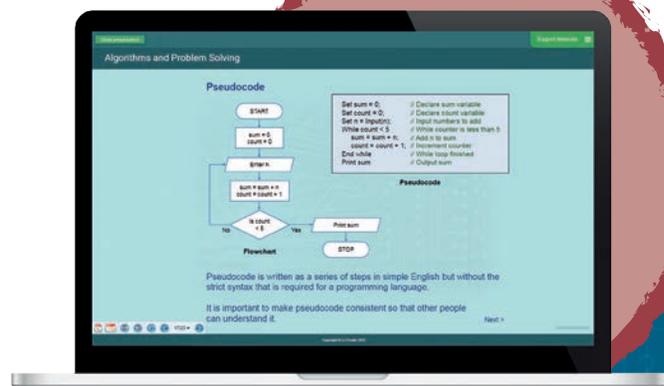
Typical Careers

Applications Software Developer, Computer Programmer, Software Quality Assurance Engineer

Lessons

- Introduction - Careers: Computer Science
- Computer Science
- Spreadsheets - Working with Data
- Communications Technology
- Workplace IT

Equipment

- Engineering Construction Kit (220-02)
- Educational Robotics Invention Kit - ERIK (250-02)
- Electronics Communications Trainer (200-01)

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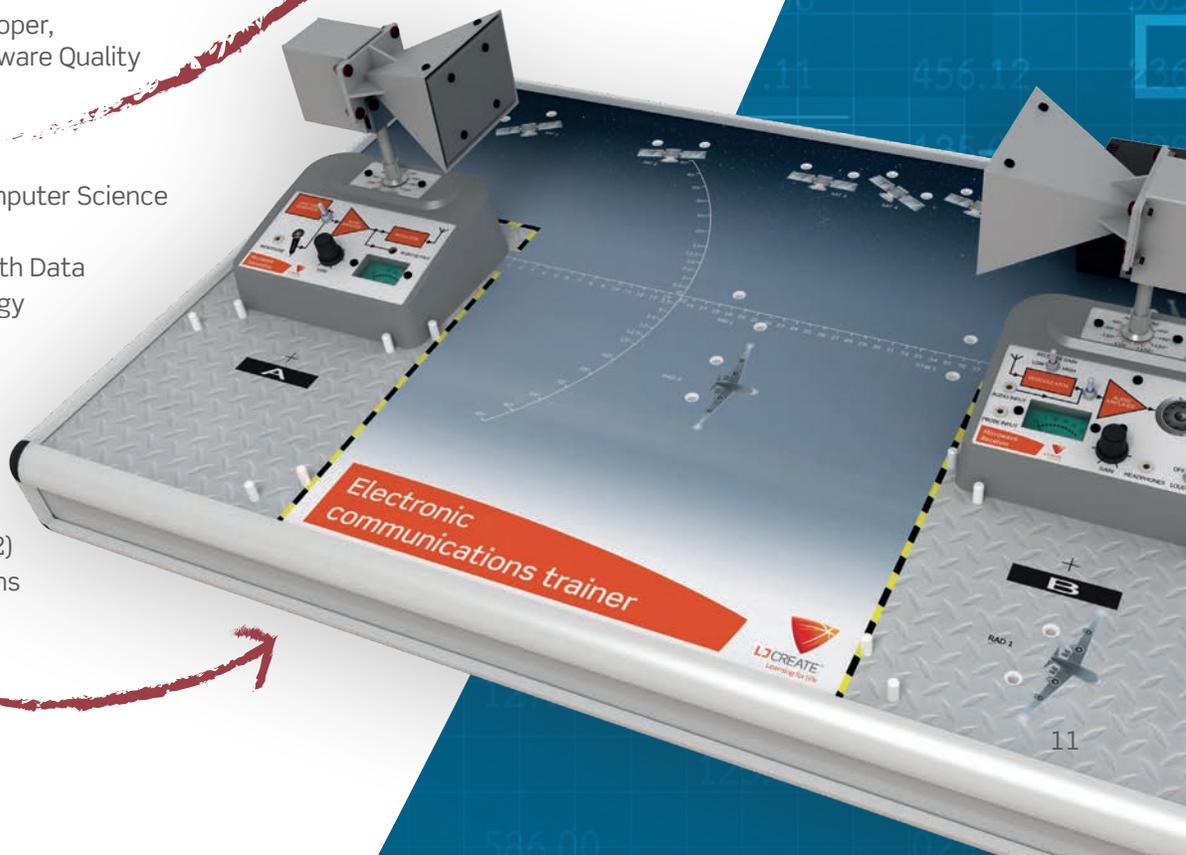
MANUFACTURING
(40-50 LESSONS)

This course investigates how products are manufactured by processing materials. Students will explore the process of injection molding plastics, and design and produce a series of injection molded products. Exploration of the machine tools used to manufacture products is covered - including lathes, mills, and CNC technology.

Learning Objectives

- Explore careers in the manufacturing sector
- Investigate how plastic products are mass produced using injection molding technology
- Design and develop plastic products and produce them using an injection molding machine
- Recognize machine tool safety procedures
- Explore the manual use of machine tools
- Explore CNC technology and CNC programming
- Apply control theory to robotic systems
- Design control systems for industrial machines and robotic systems
- Investigate 3D printing technology, material, and application
- Recognize how 3D printing can be used to produce tooling in rapid manufacturing

Typical Careers

Production, Planning, and Expediting Clerk, Production Engineer, Machinist, Machine Operator

Lessons

- Introduction: Careers - Manufacturing Technology
- Manufacturing Technology
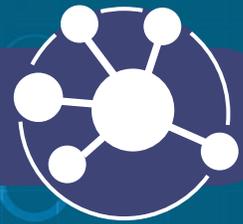- Industrial Robotics
- Machine Tools

Design Projects

- Manufacturing Technology
- Rapid Prototyping and Manufacture
- An Industrial Robotic System
- Machine Tools

Equipment

- Injection Molding Trainer (350-01)
- Engineering Construction Kit (220-02)
- Machine Tools Class Pack (506-50)
- 3D Printer - ABS
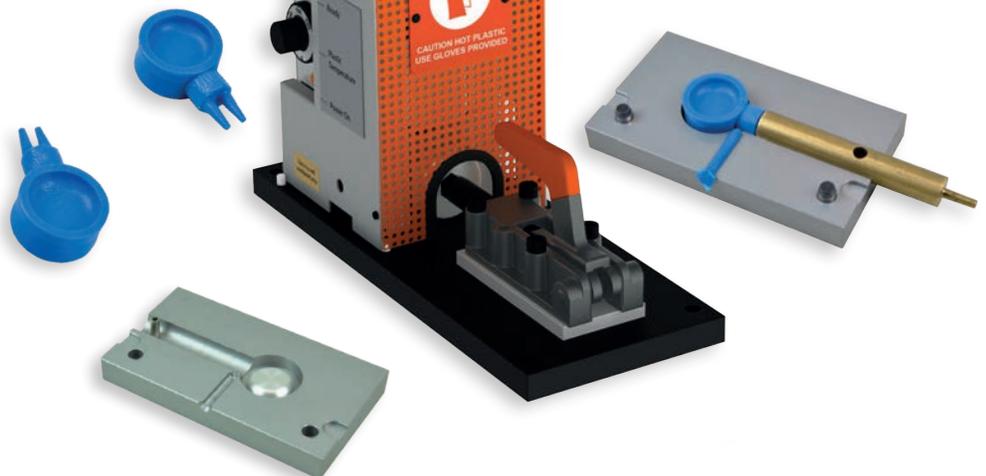
LOGISTICS AND SUPPLY CHAIN (40-50 LESSONS)

This course explores applications of mobile robotic systems. Students will also investigate the concepts of warehousing and logistics - including supply chain logistics, and **methods of transporting goods**. Investigation of PLC-based **industrial control systems**, and ladder logic programming is also covered.

Learning Objectives

- Explore careers in the logistics sector
- Investigate mobile robotic systems applications
- Explore how mobile robotic systems are controlled
- Explore sensing systems used by mobile robots
- Design mobile robotic systems for logistics, to meet a given brief
- Recognize the principles of stock control
- Identify appropriate methods of securely and safely transporting goods
- Understand the principles of quality control and monitoring in the procurement process
- Explore the use of PLC-based systems for control of industrial and logistics processes
- Develop sequence algorithms using ladder logic based programming
- Design and program industrial control solutions

Typical Careers

Robotics Technician, Robotics Engineer, Logistics Technician, Aerospace Engineer, Mechatronics Engineer

Lessons

- Introduction - Careers: Mobile Robotics
- Mobile Robotics
- Warehouse and Logistics
- Industrial Control
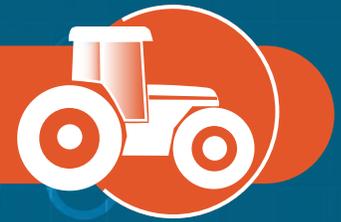
Design Project

- An Autonomous Mobile Robot

Equipment

- Industrial Control Trainer (290-01)
- Engineering Construction Kit (220-02)

NEW PROJECT

TRANSPORTATION (40-50 LESSONS)

Students will investigate the development of transportation technology and its impact on society. The course explores the **fundamental principles of transport technology** and applies physical science concepts to design transportation systems. Students will also explore technological systems in modern vehicles, including hybrid and electric vehicle technology.

Learning Objectives

- Explore careers in the transport sector
- Explore the development of transportation systems
- Apply the science concepts of power and torque to transportation systems
- Investigate the application of computer technology in modern vehicles
- Explore automotive engine and transmission technology
- Investigate the application of electronics technology in modern vehicles
- Investigate hybrid and electric vehicle technology
- Explore electric vehicle drive technology

Design Project

- An Autonomous Vehicle

Equipment

- Engineering Construction Kit (220-02)
- Displays and Accessories Systems Panel Trainer (752-01)

Typical Careers

Automobile Engineer, Vehicle Designer, Automotive Technician, Cargo and Freight Agent

Lessons

- Introduction - Careers: Transportation Technology
- Transportation Technology
- Automotive Technology
- Introduction to Hybrid and Electric Vehicles

1 TACHOMETER	9 SEATBELT WARNING LIGHT
2 FUEL GAUGE	10 IGNITION WARNING LIGHT
3 ENGINE TEMPERATURE GAUGE	11 OIL PRESSURE WARNING LIGHT
4 SPEEDOMETER	12 HIGHBEAM INDICATOR LIGHT
5 VDO (VEHICLE DISPLAY OUTPUT)	13 AIRBAG SYSTEM WARNING LIGHT
6 WINDSHIELD WIPER SYSTEM	14 BRAKE FAILURE WARNING LIGHT
7 AUDIO HEAD UNIT	15 AUDIO SYSTEM AND WIPER SYSTEM TESTPOINTS
8 ANTENNA	

LJ CREATE
Learning for life

DISPLAYS AND ACCESSORIES TRAINER

AGRICULTURE (40-50 LESSONS)

This course investigates the development of agricultural technology and its impact. Students explore the **application of biotechnology in agriculture**, and the use of control principles in agricultural systems. Students will also explore plant biology and investigate the importance of soil in agriculture.

Learning Objectives

- Explore careers in the agriculture sector
- Investigate the development of agricultural machinery and its impact
- Explore the application of biotechnology in producing sustainable energy resources
- Design automated agricultural machinery
- Explore the use of technology in the design and control of artificial environments
- Recognize the impact of human activity on ecosystems
- Carry out soil analysis and recognize the importance of natural resources for agriculture
- Explore the use of natural resources for production of materials and energy
- Explore fuel cell technology and its efficiency
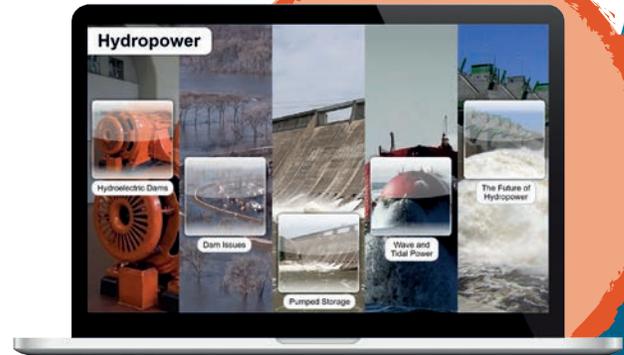
Typical Careers

Agricultural Engineer,
Food Science Technician,
Farm Equipment Mechanic,
Agriculture Technician

Lessons

- Introduction - Careers: Agricultural Technology
- Natural Resources
- Agricultural Technology
- Energy Resources

Equipment

- Sustainable Energy Production Student Resource Pack (100-02)
- Engineering Construction Kit (220-02)
- Earth Science Apparatus Kit (513-01)

For more information on our range of resources, please contact: