SREB | High Schools That Work

Advanced Career

Integrated Production Technologies Curriculum

College or Career?...Why Not Both?

Advanced Career combines college-ready academics with authentic, hands-on projects.

Schools are challenged to better prepare students for a wide array of postsecondary options. The workforce of today and tomorrow demands a higher level of skill — people who grasp complex problems, understand technology and troubleshoot problems.

Advanced Career (AC) answers both of these needs. By fusing a rigorous academic core with challenging project work and advanced technology in a career pathway program of study, AC courses give students a greater depth of knowledge and skills and prepare them for more options after high school.

Advanced Career provides:

- ready-to-implement AC course work for students
- comprehensive training for teachers
- access to tools and technology for project-based learning
- end-of-course assessments
- opportunity for industry certification and/or dual credit

Integrated Production Technologies

Advanced Career's STEM curriculum — *Integrated Production Technologies* — engages students in using innovative industry-driven technologies to imagine and design new and improved products. Great entry-level jobs leading to challenging, high-paying careers are available across the nation for students who have the academic and technical knowledge and skill sets to succeed. Students also need creativity and problem-solving abilities to coordinate information and analyze data. With these skill sets, students will be prepared to dream, build and maintain cyber-mechanical systems; invent unmanned exploration vehicles; apply electrical and mechanical engineering principles to the construction of production systems; and use logistics to develop solutions to the modern world's most pressing needs and wants.

This four-course AC sequence will allow students to apply what they learn in physics, chemistry and biology to real-world projects using emerging, cutting-edge materials. Students will work on the frontiers of product development by applying nanotechnology to new areas of need. Students will reengineer existing products to reduce the energy and material costs required to produce them, invent new products, and create more durable and efficient products using automated computer-aided design and manufacturing programs.

Across the curriculum, working in teams and in online communities with industry professionals, students will learn by applying engineering design processes to authentic project-based assignments. Students will engage in 3-D computer-aided design, documentation, prototyping, testing and analysis. Students will also design modern production systems, create energy efficient work cells and explore robotics with the programmable logic controllers and computer numerical control systems used in the world's leading industries.

The curriculum also incorporates the lean management tools and techniques used by leading industries to improve their processes, increase the quality of their products and make them more competitive. Students will use advanced measurement tools to gather quality control data and apply principles from Six Sigma, lean manufacturing, statistical process control, total quality management and inventory control to design just-in-time production systems.

Students completing the program may become a National Instruments' Certified LabVIEW Associate Developer (CLAD) and may be prepared for earning other relevant industry certifications.

Integrated Production Technologies was developed by SREB and Kentucky, with support from the Bill & Melinda Gates Foundation, as part of a multi-state consortium to improve career and technical education in this country.

For more information about other Advanced Career curricula, visit sreb.org/AC.

Advanced Career
Integrated Production Technologies

Integrated Production Technologies will appeal to students who want to work with cutting-edge materials, using their knowledge of physical and biological sciences, to create products emerging from new advanced technologies in cost-effective ways.

Course 1:
Advanced Technology for Design and Production

This course will engage students in the use of modern technologies in the design and improvement of products. Students will use three-dimensional CAD software in the creation and analysis process. Students will document designs using standards set by industry for design documentation. Students will implement methods of green production and just-in-time component supply which allow for the lowest cost and highest quality products. Students will design and troubleshoot data acquisition, programmable logic control, process monitoring, automation and robotic systems. Students will incorporate sensing and vision systems, utilizing cameras and sensors to control automated systems.

Course 2:
Systems of Advanced Technology

In this course, students will apply the technologies that are found in modern clean, production environments. Students study effective and energy efficient control of pumping, conveyors, piping, pneumatic and hydraulic control systems. Students apply total quality management to production design to assure quality. Students also focus on properties of materials and material testing, creating documentation to support designs, examining properties and justifying material selections based on properties. Students learn that old products become the new raw materials for new products.

Course 3:
Mechatronic Systems for Advanced Production

Students will design cost-effective work cells incorporating automation and robotics to improve quality of final products. The advanced production in this course depends on the use and coordination of information, automation, network systems, vision and sensing systems. Students will design and create mechatronic systems and automated tooling to accomplish these advanced tasks. Students produce authentic documentation about their cyber-mechanical systems and the integration with data to control and monitor processes.

Course 4:
Design for the Production of Advanced Products

Students will create plant designs to process and automatically assemble materials into new products. Students follow the process of developing and producing a new product from prototype to final product. They will accomplish this by creating a production flow plan that allows for the mass production of the product. Students will analyze and evaluate all aspects of the design and production processes with an emphasis on clean, lean and green production. Students will utilize data acquisition, quality control processes and Six Sigma methodology to control production.

Key Features of Advanced Career

Fully Developed Pathway Programs

Advanced Career (AC) encompasses a coherent sequence of four ready-to-implement courses; comprehensive training for teachers; access to tools and technology for project-based learning; and end-of-course assessments. To ensure fidelity from site to site, each course has a syllabus that includes instructional philosophy, instructional delivery and support systems, assessment and a recommended grading system.

Advanced Career Programs of Study

Each AC program of study (POS) is a progression of non-duplicative courses joined with a college-ready academic core and aligned from high school to postsecondary studies. The integration of academic and technical content in each POS prepares students for more options after high school graduation, offers opportunity for dual credit and leads to an industry-recognized credential, advanced training, or an associate's or bachelor's degree. The high-skill, high-wage career fields represented among the AC programs of study are important to the economy.

Project-Based Learning

Each course is designed around project-based units — featuring essential questions, project descriptions, authentic roles and tasks that require students to utilize an industry-recognized decision-making process. Assignments in AC courses encompass essential elements of good project-based learning to engage students in an extended process of asking questions, using resources and developing answers. Students collaborate and work in teams and develop important 21st-century skills.

Blended Learning Experiences

AC course work creates rigorous blended learning experiences for all students. Students apply their academic and technical skills to real-world projects in ways that advance their literacy, math, science and technical knowledge and skills, and strengthen their habits of behavior and mind for success.

Technology and Software

Students employ industry-standard data acquisition hardware and software systems to complete authentic tasks simulating the work of professionals in the field.

Assessments

Each project unit includes formative and summative assessments. Each course has an end-of-course assessment that measures both academic and technical achievement with the performance level needed for jobs, advanced training and postsecondary credit-bearing courses. In addition, students and teachers complete surveys about what works or does not work in the AC course. This serves to inform continuous improvement of the AC program.

Counseling for Careers

Student and parent orientation to each AC program of study highlights the career field, including requirements for jobs and postsecondary study in the career field. Each AC course has a career and education exploratory component. Counselors trained to support the AC program will assist students in developing a career and education plan aligned with students' goals and aspirations.

Teacher Selection, Professional Development and Support

Teachers are selected who have strong math skills and experience in the pathway career field. Staff development is essential and includes an intensive two-week summer institute for teachers to prepare them to teach each course and to use a project-based approach. They will perform students' assignments and use the tools developed by national industry partners. A support team including the principal, counselor and academic teachers in literacy, math and science learn how to support AC teachers and students in course implementation.

Dual Credit and Industry Certification

Courses three and four in the AC program offer the potential for dual credit when a state or district has an established process for approving such courses. Each AC program of study also offers opportunities for industry certification for students who complete the program.

Collaboration and Partnerships

Ongoing relationships among education, business and other stakeholders are central to AC pathway programs. Representatives from industry and postsecondary institutions have helped shape the curriculum design and technical content. Serving as an expert panel, they have collaborated with secondary educators and state education agency staff to identify authentic learning experiences for students that can lead to additional opportunities after high school. Organizations represented in the development of the Integrated Production Technologies Pathway Program include:

3M Company
Bowling Green Metalforming, LLC
Dixie Crystals
Dow Corning Corporation
DuPont
Eastern Kentucky University
Ford Motor Company
General Electric
General Motors Company
Georgia Center of Innovations for Manufacturing
Georgia Quick Start
Georgia Institute of Technology
Gulfstream Aerospace Corporation
Kentucky Association of Manufacturers
Kentucky Community and Technical College System
Kentucky Department of Career and Technical Education
Link-Belt Construction Equipment Company
Metalsa, S.A. de C.V.
Mohawk Industries, Inc.
Murray State University
National Association of Manufacturers
National Instruments
Parker Hannifin Corp
Proctor and Gamble
Robins Air Force Base
Siemens Corporation
Shaw Industries Group, Inc.
Southern Regional Education Board
Southerland & Associates
Technical College System of Georgia
Toyota Motor Engineering & Manufacturing North America, Inc.
University of Kentucky
Wacker Polymers
Wagstaff, Inc.
Western Kentucky University