Key Features of Advanced Career

Fully Developed Pathway Programs

Advanced Career (AC) STEM Pathway Academy curricula encompass 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 is a progression of non-duplicative courses joined with a college-ready academic core and aligned from high school to postsecondary studies — grades nine through 12 or nine through 14. The integration of academic and technical content in each program of study 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 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 a series of projects — 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.

Connected 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, mathematics, 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, software, robotics and control systems to complete authentic tasks simulating the work of professionals in the field.

Assessments

Each project 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 program of study. This serves to inform continuous improvement.

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 of study will assist students in developing a career plan aligned with students' goals and aspirations.

Teacher Selection, Professional Development and Support

Teachers are selected who have strong mathematics 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, mathematics and science learn how to support AC teachers and students in course implementation.

Dual Credit and Industry Certification

Courses 3 and 4 in the AC curricula offer the potential for dual credit when a state or district has an established process for approving such courses. Each AC pathway 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 **Automated Materials Joining Technology** pathway program of study include:

American Electrical Power
American Welding Society
Columbiana County Career/Technical Center
Columbus State Community College
Edison Welding Institute (EWI)
Keysafety (AWS)
Lincoln Electric
Rockwell
Miami University
Miami Valley Career Technology Center
Ohio Department of Education
The Ohio State University Center on Education and Training for Employment
Polymer Ohio
Southern Regional Education Board
TRI-Rivers Career Center
Weldtech International

SREB | High Schools That Work

Advanced Career

Automated Materials Joining Technology Curriculum

College or Career?...Why Not Both?

The Advanced Career STEM Pathway Academy curricula combine college-ready academics with authentic, hands-on projects.

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

Advanced Career (AC) answers 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 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

Automated Materials Joining Technology.....

Advances in technology and demand for products that function within more rigorous environments drive innovations in materials development and use, structural design and product integrity. For example, automobile manufacturers need composite materials that are lightweight, fatigue resistant and easily molded to shape. The aerospace industry seeks materials that function effectively in extreme conditions. Modernization in laser technology and 3D printing drives changes in the medical device and instrumentation industry.

Through use of appropriate joining technology and the incorporation of multi-material design, product performance can be improved. Materials, however, are becoming more complex in chemical composition and structure, and the usefulness of many new materials is dependent upon improvements in joining science and technology. As new materials are developed, new methods of joining emerge. [1]

Using a project-based learning approach, students in Automated Materials Joining Technology (AMJT) explore materials joining and forming methods, computer-aided design and automated systems that transform design concepts into fully developed products. Students are introduced to a variety of career possibilities.

Career opportunities in the AMJT field include avionics technician, control systems engineer, computer programmer, materials joining engineer, metals and plastics machinist, project manager, robotics welder and more.

In this four-course AMJT curriculum, students design, build and test a variety of authentic products needed by business and industry. While applying the engineering design process, they gain a deep understanding of materials science and how materials can improve product performance. Students design products using Solid Edge software and collect data using National Instruments' LabVIEW software. They use programmable logic controllers (PLCs) to manipulate automation utilized in the assembly process.

In addition, students learn how to collaborate within diverse teams, manage projects, think critically, document research, write reports and communicate results to authentic audiences. Further, students apply science, literacy, mathematics and technical skills to effectively solve challenging real-world problems with business and industry partners.

Students completing the AMJT program may seek a variety of certifications, such as LabVIEW and Siemens PLCs and pneumatic and hydraulic technician certifications through the International Fluid Power Society.

Automated Materials Joining Technology was developed by SREB and Ohio 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.

1. Eagar.mit.edu/Eagar108, n.d.

Advanced Career Automated Materials Joining Technology Curriculum

Automated Materials Joining Technology will appeal to students who want to focus on joining and forming technologies, materials science, computer-aided design and automated systems — key facets of advanced manufacturing — while applying math and science knowledge to design and produce products.

Course 1: Introduction to Automated Materials Joining

This project-based learning course introduces students to the fundamentals of automated materials joining. Students learn how to design, build and virtually test their designs using Solid Edge software. Using the engineering design process, students learn how to manage projects; research topics; plan for the building and testing of a prototype; analyze their results; make recommendations for improvement and communicate solutions to an authentic audience. Student teams create jigs, fixtures and an automated clamping system to fasten material. They program a robotic arm to control the spreading of adhesive, and design, build and test an automation system for joining the materials. Automated materials joining technology/industry standards and academic literacy, mathematics and science standards are applied to develop prototypes.

Course 2: Applications in Automated Materials Joining

Building on the concepts learned in Course 1, students engage in more complex materials science applications beginning with a reverse engineering project. Students disassemble and analyze a product to determine how they might improve its performance. Heat is applied to materials to change their molecular structure and LabVIEW is used to measure the changes. Different joints are explored and tested using filler metals. Students collaborate to create an automated quality control vision system to govern placement in an automated assembly system. They learn how to write quality engineering reports that communicate the process used and detail their findings. Students sharpen their skills by presenting to authentic audiences.

Course 3: Advanced Concepts in Materials Joining

In Course 3, students apply their knowledge and skills to produce new prototypes. They begin with programming a robot to create acceptable welds. They work with industry partners in a quality control lab where they examine the molecular changes in a tank that failed and test their recommendations to determine if they solved the problem. Students experiment with welding dissimilar metals utilized in battery applications. Working with a business partner, students automate a process to decrease assembly time and solve real-world problems through the application of Total Quality Management principles. Students focus on proposal writing as well as math and science standards integrated in the projects.

Course 4: Projects in Automated Materials Joining

Course 4 is a culminating course where students apply what they have learned in Courses 1-3 to real-world scenarios. Teams work collaboratively to analyze problems, create solutions and focus on methods of automation analysis to solve the seven issues of waste. They create a conceptual model of an amusement park ride that uses welds that can withstand high impact loads. Students design, build and test a product for automated assembly and create and test an automated process to assemble the prototype. Two projects require students to write a white paper. Depending on state policy, students who successfully complete the course may be eligible for articulated or dual college credit.