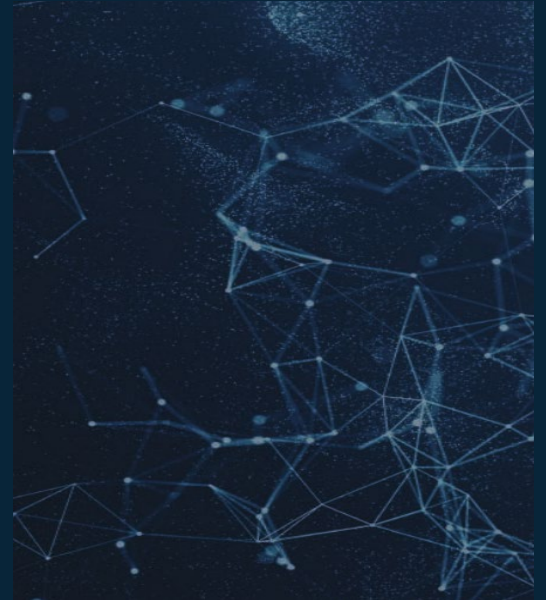




Beyond the Classroom

How EMAC and Durham Tech Built an Industry-Connected PCB Design Course

A Case Study in Workforce Development Through Industry-Academic Collaboration



USE CASE

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Executive Summary

Durham Technical Community College partnered with the Electronics Manufacturing and Assembly Collaborative (EMAC) to build an industry-connected *PCB Design & Manufacturing* course within its Electronics Engineering Technology Program. Over eight weeks, EMAC worked alongside Program Director Dr. Solomon Mingle to develop lecture materials, secure no-cost professional Altium Designer licenses for every student, and connect students directly with practicing engineers and regional manufacturers, including Bayatronics, Blur Product Development, and Murano Corporation. Rather than functioning as a guest-speaker series, industry engagement was built into the curriculum from the start.

By the end of the inaugural cohort, Durham Tech reported stronger student understanding of PCB manufacturing concepts, increased confidence using professional design tools, and the first employment conversations between students and a regional manufacturer. This use case outlines how the partnership was built and offers a model other institutions can adapt with EMAC's support.

The Workforce Challenge

Electronics manufacturing underpins nearly every modern industry. Aerospace and defense, medical devices, telecommunications, industrial automation, and consumer electronics all depend on printed circuit boards. Employers across these sectors report a consistent gap: graduates often arrive with strong engineering fundamentals but limited exposure to the tools, workflows, and manufacturing environments they will work in from day one.

That gap extends beyond software skill. Understanding how a PCB moves from design through manufacturability, assembly, testing, and production requires exposure that most engineering technology programs struggle to build into a standard curriculum: access to industry-standard software, working manufacturing floors, and practicing engineers willing to invest time in students.

Closing this gap requires more than updated course content. It requires colleges and industry to treat workforce development as a shared responsibility, embedding real engineering practice into instruction rather than layering it on afterward. Durham Technical Community College set out to build exactly that kind of program.

Building the Partnership

Dr. Solomon Mingle, Program Director and Instructor of Durham Tech's Electronics Engineering Technology Program, recognized the growing demand for PCB design talent within North Carolina's expanding electronics manufacturing ecosystem. He envisioned a course that would connect engineering fundamentals with practical industry experience and partnered with EMAC to build it.

EMAC's mission is to strengthen the electronics manufacturing workforce by connecting education, industry, and workforce organizations. Rather than serving as an outside advisor, EMAC became an active collaborator throughout the course's development, working alongside Dr. Mingle to shape both the curriculum and the industry experiences built around it.

EMAC INSIGHT

Effective workforce development begins long before students enter the job market. The strongest programs combine classroom instruction with direct exposure to the professionals, technologies, and manufacturing environments students will encounter in their careers.

What EMAC Helped Build

The PCB Design & Manufacturing course ran as an eight-week progression through the full PCB development lifecycle: fundamentals, schematic capture, PCB layout, routing strategies, component placement, Design Rule Checks (DRC), Design for Manufacturing (DFM), documentation, assembly considerations, testing, and quality assurance. Each topic built on the last, so students learned not just how to design a board but why engineering decisions carry consequences downstream in manufacturing.

EMAC worked alongside Dr. Mingle to develop the lecture materials used throughout the course, grounding instruction in current industry practice rather than textbook examples alone.

Software access was one of the most significant barriers EMAC helped remove. Educational versions of PCB design software often limit students' exposure to the tools professionals actually use. Through Altium, every student received a professional educational license for Altium Designer, giving them hands-on experience in the same design environment used across the electronics manufacturing industry throughout the full course, rather than encountering it for the first time after graduation.

CASE STUDY HIGHLIGHT — Industry-Informed Curriculum

Rather than teaching PCB design as a software course, Durham Tech and EMAC built instruction around the complete product lifecycle, connecting design decisions to manufacturing, quality, inspection, testing, documentation, and long-term reliability.

Industry Engagement in Action

Industry engagement was built into the curriculum throughout the eight weeks rather than concentrated in a single guest lecture or tour. As students progressed through fundamentals, layout, DRC, and DFM, each classroom concept was reinforced through direct contact with people working in the field.

Fred Dimock, Principal at FCD Global Services, opened the industry sessions with an introduction to career pathways in electronics manufacturing, emphasizing the combination of technical competency, professional communication, and continuous learning that employers look for. He later returned with a technical presentation on professional PCB design practices and the relationship between design and production, reinforcing the DRC, DFM, and manufacturing-constraint concepts students had already begun studying.

Students then took what they'd learned into two manufacturing environments. At Bayatronics in Concord, North Carolina, students observed live electronics assembly including component placement, SMT assembly, inspection, testing, and quality assurance, with several students working hands-on with SMT placement and inspection equipment under staff supervision. The visit made Design for Manufacturing concrete: students could see directly how design choices affect assembly efficiency, cost, and reliability on a working production floor.

At Blur Product Development in Cary, North Carolina, the perspective shifted from manufacturing to product development. Engineers introduced students to human-centered design, prototyping, regulatory considerations, and testing and validation for medical devices and other advanced technologies, and showed how multidisciplinary teams move an idea to a manufacturable product.

The course closed its industry programming with a presentation from Sree Rajagopalan, CEO of Murano Corporation, on advanced PCB applications in defense, industrial automation, Digital Twin technologies, and smart infrastructure, giving students a wider view of the industries their foundational skills could support.

EMAC INSIGHT

Industry engagement works best when it's built into the curriculum, not layered on top of it. Aligning guest speakers, technical projects, and facility visits with what students are actively learning helps them connect engineering concepts to professional practice in real time.

Outcomes

According to Durham Tech's industry engagement reports, students in the inaugural cohort demonstrated stronger understanding of PCB manufacturing concepts, greater confidence using Altium Designer, and a clearer appreciation for Design for Manufacturing and manufacturing requirements. Exposure to manufacturers, engineers, and technology leaders broadened students' sense of the career paths available to them in manufacturing, product development, and quality engineering alike.

The partnership also strengthened Durham Tech's regional industry network. Through EMAC, Bayatronics, Blur Product Development, Murano Corporation, Altium, and HamPCB all became active participants in the course. By its conclusion, Bayatronics had begun working with Durham Tech to explore employment opportunities for students from the inaugural cohort — an early, concrete signal that the model can create direct pathways from classroom to career.

The Model: How EMAC Can Help You Build This

The Durham Tech collaboration offers a model other institutions can adapt. A few principles carried the most weight:

- Bring industry into curriculum development early, not after a course already exists.
- Remove the software barrier — access to industry-standard tools changes what students can practice, not just what they can watch.
- Tie every guest speaker, project, and facility visit to something students are actively learning, rather than treating them as standalone events.
- Treat industry relationships as long-term investments — the connections built during a course can outlast it, in curriculum, continued collaboration, and student employment.

For EMAC, Durham Tech represents a practical, repeatable approach to workforce development: partnering with faculty on curriculum, providing industry-informed instructional materials, connecting students with professional software through companies like Altium, and coordinating manufacturers and engineers as active participants in the classroom, not guests passing through it.

Next Steps

If your institution is exploring how to build stronger connections between classroom instruction and industry practice, EMAC can help facilitate that partnership, from curriculum development, to industry engagement, to access to professional tools.

For more information, contact: info@electronicsworkforce.com