

Innovative approaches for training precision optics technicians

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Abstract

The dramatic shortage of optics technicians is having an impact on the ability of America to compete in the international marketplace. This has caused educational institutions to rethink how they educate the future workforce. Innovative approaches such as, quick-start, microcredentials, remote learning and partnerships are changing the educational landscape.

Apprenticeship, Optics technician, Training, Partnership, Community College, Manufacturing, Workforce, Microcredentials, Remote Learning

The Challenge

The Optics, Photonics and Imaging industry is growing at an exponential rate and is suffering from a worldwide shortage of skilled Optics technicians. Consumer, Defense and Biomedical markets account for 62% of the \$2.12 trillion global market.¹ Without Optics technicians we cannot be competitive on the international scene. Furthermore, it is predicted that between 20% and 30% of experienced optics technicians and engineers are approaching retirement, resulting in a severe worldwide shortage of skilled optics technicians and loss of institutional knowledge.

The need to maintain a skilled optics technician workforce has resulted in the development of innovative teaching methods by educational institutions:

- Quick-start programs, in which students are learning at an accelerated pace, gaining the foundational knowledge and skills required to obtain an entry level position in the precision optics industry.
- Microcredentials, short-term training programs, consisting of courses designed to meet current employer needs. Microcredentials can be stacked together to allow the participant to earn a community college certificate or associate degree.
- Remote Learning, where students around the country can join classes offered at Monroe Community College to earn credit towards an apprenticeship, college certificate or associate degree.
- Partnerships between community colleges, such as Monroe Community College in Rochester, NY and Sussex County Community College, in Newton, NJ, to replicate MCC's curriculum and hands-on lab experience. Employers also need to partner with community college to take an proactive role in the training of their workforce.

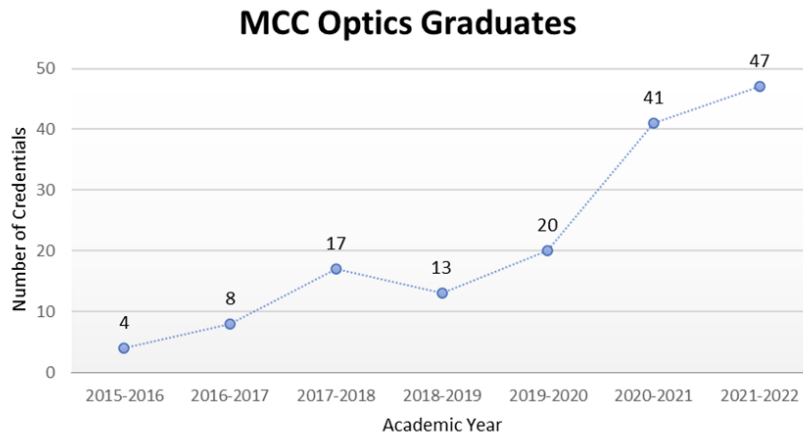
These innovative teaching methods will produce an increase of skilled optics technicians in a short time frame, and compliment the longer-term Optics Manufacturing Technician Registered apprenticeship that several companies have implemented.

Optical Systems Technology Program

Monroe Community College (MCC) was founded in 1961 as a member of the State University of New York (SUNY) system with a focus on serving the educational needs of the local community. Soon after, Eastman Kodak company sponsored the creation of the Optical Systems Technology (OST) program as a pipeline for affordable

training of an optical workforce within Kodak. Xerox Corporation and Bausch & Lomb also had a need for optics technicians.

Rather than abandon the program when the original purpose of the program lost relevancy, because Eastman Kodak, and Xerox Corporation began downsizing their workforce and the demand of skilled optics technicians decreased, MCC sought to revitalize and transform the program to serve the needs of the broader optical industry. This transformation occurred over the last six years and continues today.



Under the guidance of Alexis Vogt PhD, Endowed Chair & Professor of Optics, the number of Optical Systems Technology credentials awarded by MCC has increased from 4 in 2016 to 47 in 2022, which aligns with the increase in enrollment from 38 optics students in Fall 2015 to 99 optics students in Fall 2022.

As one of four main programs of MCC’s Engineering Technology Department, the OST Program advances the mission of MCC’s Economic Development and Innovative Workforce Services Division by providing a direct path to employment in the optics industry for Rochester, NY.

Quick-Start

Quick-start. Fast-track. Accelerated. These training programs have been developed to respond to employers’ request for additional skilled workers. Most industries, including optics and photonics, need to increase their workforce to increase production to satisfy customer demand. These programs allow students to learn at an accelerated pace to gain hands-on experience and critical skills that are in high demand, preparing them for immediate employment in the advanced manufacturing industry. Accelerated programs range from 3 to 22 weeks. That means the students can enter the workforce, and add value, quicker.

Monroe Community College offers several fast-track programs. Two of the programs with implications in the optics, photonics and imaging industry are Accelerated Precision Tooling, a 22-week program that provides first-hand experience in the most current precision machining techniques and technology, and Mechatronics Jumpstart, an 11-week program that teaches the principles of electrical-mechanical and computer control technologies used in advanced manufacturing.

Two new industries are establishing facilities in western New York State that will have a major impact on workforce development. Edwards Vacuum is a global leader of vacuum and abatement, committed to minimizing the negative environmental impacts of semiconductor manufacturing.² Micron Technology plans to spend up to \$100 billion building a mega-complex of computer chip plants in Syracuse’s northern suburbs in what would be the largest single private investment in New York State history, and create up to 9,000 jobs over the next 20 years.³

These companies are going to require a rapidly-trained workforce in order to begin production. Representatives from Edwards Vacuum and Micron have already met with MCC, viewing our classrooms, labs, and equipment, because MCC will be a major contributor in training their workforces.

MCC has also developed two fast-track workshops to meet optics industry requests for workforce training that fits production schedules. Introduction to Diamond Turning and Magnetorheological Finishing (MRF) are 40-hour workshops conducted in MCC's state-of-the art optics laboratories over a period of three weeks (nine half-day sessions that meet three days per week).

Microcredentials

Microcredentials are compact credentials that complement but differ from certificate and degree programs in that they are smaller and more focused, designed to provide immediate workforce ready skills, knowledge, and experiences, and wherever possible, to also serve as a pathway to an initial or advanced degree (stackable).

MCC's microcredentials are:

- High academic quality
- Stackable together with other microcredentials or learning experiences to meet the requirements of a certificate or degree
- Designed to meet current and emerging market needs and align with relevant industry standards.
- Portable and recognized beyond MCC

State University of New York (SUNY) has been encouraging member colleges to create microcredentials that meet the following characteristics:⁴

- Verify, validate and attest that specific skills and/or competencies have been achieved
- Endorsed by the issuing institution
- Having been developed through established faculty governance processes
- Designed to be meaningful and high quality.

MCC has the unique opportunity to transform the local and national technical workforce in the optics industry by offering a new 14-week microcredential, fast-track training program *Optical Fabrication Essentials*.

- Students will receive an intensive experience working hands-on with faculty and state-of-art manufacturing labs.
- Students will be mentored by industry sponsors and MCC faculty serving learners' unique needs and ensuring academic success.
- Program completers learn the skills necessary for success as an optics technician in the shortest time possible (14 weeks!) – truly transformative for students who cannot wait 12 or 24 months to complete a degree program but need a well-paying job now.
- By leveraging MCC's extensive industry connections, completers have the opportunity for placement in a job at a local company by week 15.

MCC's *Optical Fabrication Essentials* microcredential will provide a jump start for an individual wanting to enter into the optics manufacturing industry by providing the knowledge and skills required to be effective on the first day of employment. Students who earn this credential are expected to be hired at an above entry-level starting wage and advance more quickly in the workplace. Registered apprentices who complete their required on-the-job learning and related technical instruction will earn journeyman status certification from either the State Apprenticeship Agency (SAA) or the US Department of Labor, Office of Apprenticeship (USDOL/OA), along with the *Optical Fabrication Essentials* microcredential.

Microcredentials have an additional value that they can provide equity into the student population. The MCC Optical System Technology student population is diversifying in gender and ethnicity distribution. The stacking ability of microcredentials will allow students who need additional support or time to take smaller step to accomplish their goals

ENROLLMENT	2019	2020	2021	2022
Optics Students	46	79	101	114
Female Students	10 (22%)	20 (25%)	30 (30%)	28 (25%)
Students of Color	7 (15%)	17 (22%)	28 (28%)	34 (30%)



Remote Learning

COVID 19 changed the face of learning forever. The suspension of in-person classes forced educational institutions to develop remote and online courses so that students could continue their college careers and essential workers could complete their apprenticeships. Many instructors were not ready for this change. They have to make both basic pedagogy and andragogy changes to their teaching style since, over Zoom, they could not gauge how well the students were understanding their lectures.

The Optical System Technology program at Monroe Community College had to switch to online learning practically overnight, especially since most of the optics employers in the areas were deemed essential workplace and requiring additional skilled workforce.

The online curriculum overcame the distance barrier to expanding the OST students and Optics Manufacturing Technician apprenticeships. The apprentices can attend the lecture for the classes online from anywhere in the country. For the hands-on lab portion, the apprentices have a couple of options. One option is to complete a two-week lab session at MCC during the summer and winter breaks. The other option is for the apprentices to complete the lab work at their facilities under the guidance of an in-house instructor, given they have equipment availability. The apprentice will complete similar exercises and reports on results.

Partnerships

With the high demand and short supply of skilled Optics technicians MCC cannot graduate enough OST students to fill the gap. Other community colleges will need to implement their own optics curriculum and increase the number of students in optics-related courses. Employers will also have to contribute to increasing skilled workers by developing apprenticeships, partnering with community colleges to create a pipeline of students, and allowing experienced employees to work as part-time adjuncts.

Apprenticeship is a structured “earn and learn” training model that requires on-the-job learning along with related technical instruction. Apprenticeships can benefit both the employer and employee. The employer benefits with a more stable workforce, improved attendance, productivity and quality. The employee earns long-term career opportunities, workplace relevant skills, periodic wage progression, and industry recognized credentials.

The American Center for Optics Manufacturing (AmeriCOM) focuses on workforce development, supply chain stability, and manufacturing innovation in the precision optics industry. At the core of the AmeriCOM ecosystem model are community colleges and other vocational learning centers that offer programs in optics technician training.⁵

Monroe Community College has a complete optics fabrication capacity. The MCC labs include conventional fabrication with generators, grinding pots, and spindle polishers, as well as computerized OptiPro 80 grinding and polishing equipment. AmeriCOM is providing guidance and funding for additional community colleges to institute optics curriculum and replicate some of MCC's lab equipment at their facilities. Among the colleges are Sussex County Community College (Newton, NJ), Valencia College (Orlando, FL), and Front Range Community College (Boulder, CO). This partnership will assist in expanding apprenticeship opportunities to a greater number of employers.

Employer/college partnerships, such as the Corning Technician Pipeline Program, L3Harris Technical Training Program and the Optics Manufacturing Technician apprenticeship demonstrate how employers are taking responsibility to grow their future skilled workers.

Students accepted into the Corning Technician Pipeline Program (TPP) receive full financial and academic support for two years while earning an associate degree in Optical Systems Technology at Monroe Community College or one of several technology programs at Corning Community College. TPP participants receive a full-time salary throughout the two-year period while working with Corning mentors for eight hours per week during school semesters, and full-time during school breaks and summers. Upon successful completion of their AAS degree and all requirements of TPP, students are normally hired into Corning technician positions, and expected to work at one of Corning's facilities for at least three years.

L3Harris Technologies recently announced establishing a new program enabling New York residents to attend MCC through a fully funded sponsorship agreement with the L3Harris Technical Training Program (TTP).

The 24-month program, developed by L3Harris and MCC, immerses electrical engineering technology students into a professional workplace experience through part-time employment at the company while they pursue their degree. Students will take part in rotational assignments, formal mentorship and learn technical test and troubleshooting skills to prepare them with the tools needed to excel in the workforce.

"Through the TTP partnership, MCC students will have valuable opportunities to receive a quality education tuition-free and gain paid work experience in cutting-edge manufacturing systems from industry professionals," said Dr. Robin Cole Jr., Vice President, Economic and Workforce Development and Career Technical Education, MCC. "As the community's college, MCC collaborates with employers like L3Harris in uplifting the lives of our students and fulfilling evolving workforce demands."⁶

Summary

Fast Track
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Microcredentials
+
Remote Learning
+
Partnership



Skilled Optical Technicians

Dave Seeley, executive director of Rochester Works, points to the optics program at Monroe Community College as an example of the effort to address the skills gap. "It can't grow fast enough, because it needs to fit the demand for technicians and other related occupations," Seeley said. "You know, basically, you're enrolling in that program, and unless you flunk out, you're guaranteed a job, and probably the optics companies are lining up to call dibs on you."⁸

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