



Enhancing Workforce Readiness of Engineering Technicians

Prof. Christine Michelle Delahanty, Bucks County Community College

I am the Area Coordinator of Science and Engineering, the Program Coordinator for Engineering and Engineering Technology, and Associate Professor of Engineering and Physics at Bucks County Community College (Bucks). I hold B.S. degree in physics, and an M.S. in Electrical Engineering, and I was a communication system engineer at General Electric in both military and commercial communication satellite operations for over nine years. I am currently completing a doctoral program at Drexel University in Educational Leadership and Management. I establish technical, college level, programs of study for modernized classroom and laboratory curricula including online course platforms, and integrated technologies. I have been involved in several grant efforts as the author and project director that have enhanced the programs at Bucks. I am currently the PI of an NSF ATE grant to increase the number of engineering technicians in Southeastern Pennsylvania. This grant involves a collaboration with Drexel University, our Business and Innovation Department and with our Center for Workforce development. We hope that our model will be a blueprint for community colleges nationwide. I secured funding from National Science Foundation (NSF) Advanced Technological Education (ATE) in 2011 to develop a for-credit engineering technology program. In 2013, I secured funding from Dow Chemical for student research into quadrotor technology that involved a collaboration with a local high school leading to a competition at a neighboring community college. I was the faculty advisor to two student engineering teams that made the final round of the NSF AACC Community College Innovation Challenge (CCIC) in 2016 and 2017. In 2017 and 2018 I secured funding from PECO Energy to conduct a feasibility study of the alternative energy innovation from the 2016 Community College Innovation Challenge (CCIC), and to build a workable prototype. I secured funding in 2017 from Dow Chemical to conduct 3D printing exhibitions at schools in Bristol Borough, a school district with a higher percentage of underserved groups. My students and I are involved in community outreach involving 3D printing and STEM demonstrations and workshops to local community groups such as the girl scouts and boy scouts, other local community groups, and local K-12 schools. I am a senior member of Institute of Electrical and Electronics Engineers (IEEE) in the Women in Engineering (WIE) Division, a member of the Society of Women Engineers (SWE), and a member of the American Society of Engineering Education (ASEE).

Dr. Vladimir Genis, Drexel University

Dr. Vladimir Genis - Professor and Head of the Department of Engineering Technology in the College of Engineering, has taught and developed graduate and undergraduate courses in physics, electronics, nanotechnology, biomedical engineering, nondestructive testing, and acoustics. His research interests include ultrasound wave propagation and scattering, ultrasound imaging, nondestructive testing, biomedical engineering, electronic instrumentation, piezoelectric transducers, and engineering education. Results of his research work were published in scientific journals and presented at the national and international conferences. Dr. Genis has five US patents. As a member of a supervising team, he worked on the development of the curriculum for the "Partnership for Innovation in Nanobiotechnology Education" program.

Susan Herring, Bucks County Community College

Susan Herring, Executive Director of the Center for Workforce Development at Bucks County Community College, directs the college's workforce development activities as they relate to business incumbent worker training, industrial skills occupational training, adult basic literacy, and other pre-collegiate programming including college and career readiness programs for high school and out-of-school students. Susan has been instrumental in managing workforce development programs in collaboration with industry and government agencies, including the employer-driven Metalwork Training Program. This highly successful and replicable model provides entry-level, well-trained workers for local manufacturers. In addition to her experience in higher education, Ms. Herring's experience includes over thirteen years in corporate human resources management working for Fortune 500 companies, and 10 years working with school-based workforce development initiatives. She serves on several committees of the Bucks County



Workforce Development Board. Ms. Herring has a bachelor's degree in business from Sacred Heart University.

Tracy A. Timby, Bucks County Community College

TRACY A. TIMBY

PROFESSIONAL PREPARATION J.D., Widener University School of Law, 1997 M.S., Counseling Psychology, Loyola College in Baltimore, 1991 B.S., Psychology, St. Joseph's University, 1989

ACADEMIC AND PROFESSIONAL APPOINTMENTS January 2014 – Present Dean, Business + Innovation, Bucks County Community College May 2007-January 2014 – Director, Paralegal Program, Bucks County Community College August 2013-January 2014 –Associate Professor, Law, Bucks County Community College August 2010-August 2013 – Assistant Professor, Law, Bucks County Community College January 2007-August 2010 – Instructor, Law, Bucks County Community College March 2006-January 2014 Managing Partner, TimbyHunt, Attorneys at Law August 2005-January 2007 – Adjunct Professor, Law, Bucks County Community College January 2004-May 2006 – Adjunct Professor, Law, Manor College August 1998-August 2005 – Adjunct Professor Law, Delaware Valley College July 1997-January 2006 – Attorney, Timby,Haft, Kopil Fanning and Sacco

MULTIMEDIA Huffington Post, Divorce (2011) – author of article on Collaborative Divorce after age Fifty for national RSS feed publication. Thomson West, Scranton, Pennsylvania (2005) - drafting of online Family law course for Thomson West online Paralegal Program including lecture panels, virtual field trips, weekly quizzes, course project and midterm and final examinations.

PRESENTATIONS Basic Interdisciplinary Training in Collaborative Law, Co-Trainer (October 2011) Bucks County Bar Association – The Option of Collaborative Law for Divorcing Couples (April 2011) American Association for Paralegal Education – Northeast Regional Meeting (April 2011) American Association for Paralegal Education – Northeast Regional Meeting (April 2012) Basic Interdisciplinary Training in Collaborative Law, Trainer (January 2013) Bucks County Collaborative Law Group Retreat – Facilitator (April 2013) American Association for Paralegal Education – National Meeting (November 2013) Basic Interdisciplinary Training in Collaborative Law, Trainer (January 2014) American Association for Paralegal Education – National Meeting (November 2014) National Association for Community College Entrepreneurship – Presenter (October 2018) Basic Interdisciplinary Training in Collaborative Law, Trainer (October, 2018)

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Christine Delahanty, Vladimir Genis, Susan Herring, Tracy Timby

Bucks County Community College in collaboration with Drexel University will utilize funds from an NSF ATE grant to develop and integrate an innovative teaching model designed to prepare future technicians for industry by incorporating soft skills training, career exploration, and entrepreneurship. This collaborative model will formally connect the Bucks Center for Workforce Development (CWD) sector with our for-credit engineering technology program, our Business and Innovation Department, and with our educational and industry partners. This innovative project will enable our college to strengthen our technician education programs, formalize connections with CWD and our Business and Innovation Department, and prepare students for industry jobs through shadowing opportunities, employment, entrepreneurship, internships, and real-world, collaborative outreach. Our community college will collaborate with our Industry Advisory Board (IAB), CWD, and educational partners to (a) integrate an innovative teaching model for technician education that includes a formalized shadowing and internship program and connects students to opportunities in business and entrepreneurship. (b) require students to take a manufacturing laboratory course to introduce hands-on industry-related experiences; (c) include certifications that award digital badges, credit for military training, and industry experience in our engineering technology program. It is our intention that this model for an enhanced educational experience designed to increase workforce readiness of students will become a blueprint for other programs and institutions.

There is an urgent and growing need for workforce ready technicians to fill industry roles. The Bureau of Labor Statistics (BLS) indicated that the job outlook for mechanical and civil engineering technicians showed a 3% and 5% increase respectively in the 10-year span from 2018-2028, where the median salary is over \$50,000 [2]. An innovative plan must be developed to assure that the number of students enrolled in surrounding for-credit Tech Ed programs increases, and that increasing retention and graduation rates is a priority [3]. A solution to this problem is rooted in our Center for Workforce Development (CWD) and in soft skills training through our CWD, and our Business and Innovation Department. In order to increase the number of engineering technicians in our region, Bucks County Community College (Bucks) in collaboration with Drexel University is utilizing funds from an NSF ATE grant to collaborate with a local four-year institution, our Center for Workforce Development (CWD) and our Business and Innovation Department to create an enhanced curriculum for engineering technology ENGT majors. This will lead to increasing the number of students obtaining degrees in science, technology, engineering, and mathematics (STEM) fields. Increasing the number of graduates will, in turn, “provide a workforce that is prepared to ensure a healthy economy, respond to demands of national security, and maintain and elevate the quality of life.

The non-credit programs at Bucks provide high-value training and certifications that prepare individuals to enter directly into the workforce upon program completion. The CWD has grown at an impressive rate in recent years, and recently announced plans to build a new manufacturing facility at the college’s lower campus. Our CWD has completed 22 cohorts of metalwork training, and 11 cohorts of industrial maintenance training, and has graduated 288 students, and boasts a 92% job placement rate. These programs have helped to shine a spotlight on the workforce challenges affecting our region. Our CWD Metalwork and Industrial Maintenance Training Programs recently achieved status as registered pre-apprenticeship programs with the state. The success of these programs has resulted in an increase in business participation by over 300%, securing hundreds of thousands of dollars in grant funding, and was key in cementing

relationships between the college, manufacturers, local and state government, and the Workforce Development system.

Our county expects to see nearly 3,000 new jobs in advanced manufacturing in the next 10 years. This, coupled with impending retirements of baby-boomers, makes it vitally important to provide accessible means for entry into the industry sector. The ability of CWD's program graduates to seamlessly transition into a technical degree program at our college will provide a pathway for students to earn a degree while working in the industry. The credits that can be applied towards a degree will incentivize CWD students to continue their education, thus building the number of skilled technicians in the region. When developing our certification, and our for credit programs, our industry and manufacturing partners made it abundantly clear that the most important skills for success on the job are to show up to work every day, on time, ready to work, and have the ability to communicate well with co-workers. In light of industry feedback, the program was designed to fully integrate soft skills, or employability skills, with the technical training, and includes industry certifications in OSHA 10 and Forklift Safety, strict attendance and punctuality requirements, a strong soft skills component, and 6-8 company tours per cohort. In addition, CWD provides a dedicated job developer who works closely with each student to ensure they are connected with good-fit jobs.

Our Business and Innovation Department is known for its dynamic programs and courses, and for its community outreach programs designed to better prepare students for the workforce. The department recently launched a co-curricular program designed to help a student find and participate in activities on campus, throughout the county and surrounding region. Students earn points for activities, event attendance, and accomplishments at varying levels. The program focuses on competency areas including soft-skills that employers are looking for: Community Engagement, Financial Literacy, Global Awareness, and Personal/Professional Development. The formalized collaboration with our Business and Innovation Department through this NSF grant, will allow us to incorporate the successes of their department into the development of a modernized curriculum that will prepare students for the future of industry.

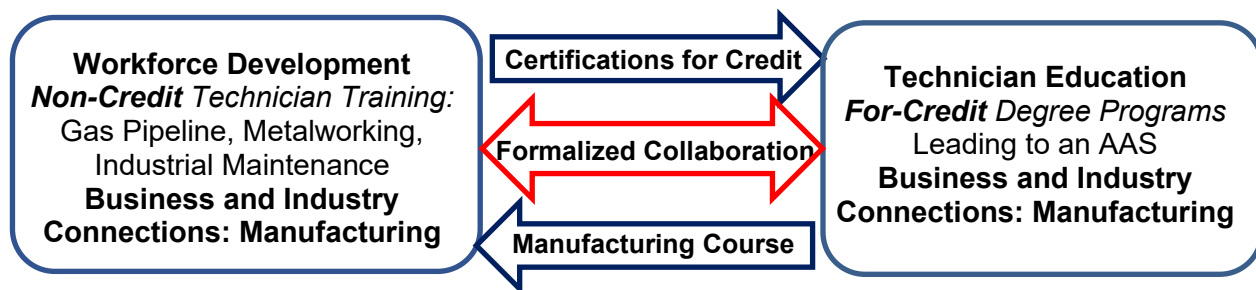


Figure 1. Collaborative model for technician education.

Through a formalized connection between our two sectors of the college, the credit and non-credits sides, the goal is to modernize the educational experience for our students to assure they are more workforce ready by establishing a model curriculum that will become a blueprint for

other institutions. Figure 1 depicts our collaborative model, that connects our credit side to our CWD, and highlights manufacturing.

We routinely receive solicitations from surrounding companies reaching out to our community college for technicians to fill internships and job openings, and it is important that we meet this growing demand. Our Industry Advisory Board (IAB) members for our engineering technology program, have indicated to us at recent meetings that they are seeking technicians and interns that have the necessary soft skills training. Company executives have raised concerns that many of the younger employees they have hired recently do not arrive to work on time, do not show up for work regularly, and some “do not even know how to use a ruler.” They have verbalized to us that the soft skills that incoming young employees need include “a willingness to learn,” “flexibility with respect to shift,” “regular attendance,” “clean cut appearance,” “passing a drug test,” and “knowing how to communicate.” Basic “hard skills” include “knowing how to use a basic tools and instruments,” “not being afraid to turn knobs,” and “being able to fix something independently,”

Members of our IAB have indicated that they will be able teach incoming technicians and interns the specific skills of the job more effectively if they encompass these very basic qualities. This soft skills gap that is a concern of our IAB, is shared by industry managers and executives nationwide. An announcement by CBS Moneywatch on May 17, 2016 indicated that “According to a survey released today by PayScale, which provides data on salaries, and executive development firm Future Workplace... More than half of all companies (60%) said new grads lacked critical thinking skills and attention to detail (56%), while 40% found fault with their writing proficiency, and 39% were critical of their public speaking ability.” [1]

In order to better understand challenges in preparing students for the workforce, we conducted round table sessions with faculty from our community college, and at the 2019 NSF ATE PI conference to help to answer the two questions, “What do our students need to become more workforce ready?” and “What can we do as educators to help students become more workforce ready?”

Some of the responses to the question “What do YOU THINK students need to become more workforce ready???” were:

- Persistence
- Experience through internships
- Know how to write a memo letter etc.
- Think and problem solve
- Confidence to learn on the job
- Learn how to think
- Open to criticism and suggestions for improving
- Sense of responsibility and ownership
- Oral and written communication skills
- Know how to ask questions and find the answers
- Clear understanding of what is expected of them

- Respect for themselves and for authority
- Be able to do things without technology

Being able to communicate was discussed as being the most important skill that students needed to become more workforce ready.

Some of the responses to “What can WE do as educators to help students become more workforce ready???” were:

- Use the college’s Student Research Conference for collaborative open ended problems
- Don’t hesitate to give an F for F work
- Reinforce soft skills through engagement
- More humanities education
- More internships
- Talk about skills to be acquired in courses
- Improve Communication
- Help students learn to take critique positively
- Enforce class and assignment requirements
- Challenge students with high expectations and provide honest feedback
- Offer competitive team assignments
- Give them work related experiences: role play and team projects
- Have them fix their errors
- Stress that the skills they are learning will help to qualify them for jobs

Our plan is to better enhance the experience of students through workforce training as part of curricula. Through this formalized collaboration of our two college sectors and departments, and of our four year institution, emphasis will be placed on utilizing the resources from our CWD certification programs to accept their credits for transfer into our engineering technology Associate degree program, to offer soft-skills training and career exploration opportunities through CWD, including guided tours of local companies, a shadowing program, and to offer our credit students opportunities to use the CWD manufacturing equipment and facilities. We plan to mimic the robust and individualized soft-skills training and job placement opportunities of our CWD with our ENGT majors. ENGT students will be invited to accompany CWD students on company tours, and join in on training components that result in industry recognized certifications. The additional certifications, in which the students will earn digital badges, will not only enhance students’ resumes, but will better prepare them for work in the industry.

Curriculum enhancements to our engineering technology program will include:

1. establishing a cohort of incoming engineering technology students for our Introduction to College course, which will include soft skills training, career exploration, and job shadowing,
2. requiring all technician education majors to take a business elective course, such as management, accounting, or entrepreneurship,
3. requiring students to take a manufacturing lab course,

4. increasing flexibility in choosing electives, where specialized concentrations will include options such as mechanical, civil, biomedical, and nanotechnology,
5. allowing students with CWD certifications to gain credit for them within the engineering technology major,
6. accepting for college credit certain certifications and courses through high school engineering technology programs to offer a pathway into the engineering technology major,
7. offering a free elective that will allow students to use their internships completed through our IAB, CWD, or our Center for Student Development and Career Services, for course credit.

The goal is to pilot this modernized program at our college and measure student success to illustrate how our enhanced model will help to better prepare our technicians and our college for the future of industry. We will closely monitor this enhanced program, assess progress, and report outcomes, so that our learning model becomes a blueprint for community colleges nationwide. By continuing to offer soft skills training, enrichment opportunities, and career exploration, to our students, we will assure that they are better prepared for the workforce. Through this model, we will further extend our vision of broadening awareness of the importance of STEM careers, and specifically in fields that require skilled technicians. This innovative teaching model will ultimately benefit not only Bucks County Community College, but also the people, educational institutions, and businesses in the surrounding region and beyond.

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