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BOARD # 398: NSF ATE: Advanced Manufacturing Professional Development Workshops for High School and Community College Educators

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Dr. Karen Wosczyna-Birch has been a champion of engineering and technology education for over 35 years. Since 1995, she has been the State Director of the CT College of Technology (COT) where her leadership has been instrumental in creating nationally recognized seamless pathway programs in engineering and technology between all 12 public community colleges in CT with 10 universities and high schools. She is also the Executive Director and Principal Investigator of the National Center for Next Generation Manufacturing (NCNGM), a National Science Foundation (NSF) Center of Excellence and a Professor of Applied Technology at Tunxis Community College. Since 2004, she has received over $30M in funding from the NSF, including two grants for international partnerships. Karen has implemented strategies resulting in an increase in the enrollment of underrepresented populations in STEM programs at the community colleges.

Karen has received numerous awards for her accomplishments as a professor and for her passion for increasing the diversity of the STEM population including the 2016 Distinguished Service Award from the international honor society Epsilon Pi Tau (EPT), the 2018 CT Women of Innovation Award in the Postsecondary Academic Innovation & Leadership Category, the 2012 New England Board of Higher Education Excellence Award for the State of CT and most recently, the 2020 HI TEC Innovative Program of the Year Award and 2021 ITEEA Special Recognition Award. In 2014, she was invited to the White House College Opportunity Summit recognizing leaders like Karen for their commitment to STEM education. She also serves on numerous local and national boards including the Epsilon Pi Tau Honor Society, Hartford High's Pathway for Engineering and Green Technology, and the Connecticut Technical Education and Career System.

NSF ATE: Advanced Manufacturing Professional Development Workshops for High School and Community College Educators

This National Science Foundation Advanced Technological Education (NSF ATE) funded National Center for Next Generation Manufacturing (NCNGM) aims to address the need for a highly skilled technician workforce at the two-year college level through its network of advanced manufacturing stakeholders. It is imperative that educators are up to date on current and future skills needed in the manufacturing workforce when educating that future workforce. The NCNGM, which expands upon the work of previous NSF ATE funding as the Regional Center for Next Generation Manufacturing, has a leadership team composed of community college faculty in advanced manufacturing disciplines from across the United States. In addition to overseeing overall grant initiatives, members of the NCNGM leadership team oversee Technology Teams tasked with identifying, disseminating and developing, when needed, best practices for student recruitment and retention, providing professional development for faculty, and creating a repository of advanced manufacturing education materials. The NCNGM partners with two NSF ATE funded projects to offer in-person and virtual hands-on professional development opportunities for high school and community college educators from across the United States.

Overview of the in-person mechatronics workshops

The NCNGM leadership team includes representatives from a Central Community College in Nebraska, which offers a mechatronics dual enrollment program with local high schools and, through its own NSF ATE project grant funding, developed professional development workshops to share the best practices of their program. Workshops are attended by high school and community college educators who currently offer or are exploring offering a mechatronics program. During these workshops, participants learn about a pathway that gives high school students access to four online entry-level, hands-on mechatronics courses and best practices for delivering those courses. The four courses are Concepts of Electronics, Intro to Instrumentation, Intro to PLCs, and Application of Industrial Sensors. Participants also build a desktop mechatronics trainer based on which of the four courses the workshop is covering and keep it for use in their own classrooms. To accomplish this, the workshop instructors provide participants with all the components of the desktop trainers from metal bases to all electrical and mechanical parts. Participants go step-by-step through the process of assembling the trainers as their students would do including troubleshooting any issues. While each trainer works independently, all four can be connected. Finally, participants are provided with the curriculum that corresponds to the course.

The NCNGM began its partnership in professional development with Central Community College by hosting an eight-hour Concepts of Electronics Workshop at the High Impact Technology Exchange Conference (HI-TEC) in Salt Lake City in 2022, which was attended by twenty high school and community college educators from across the country. In February 2023, a full four-day Concepts of Electronics Workshop was held for high school and community college educators at Hillsborough Community College in Florida. In March 2024, a workshop was held for faculty members from Columbia Gorge Community College in Washington. During

the summers of 2023 and 2024, all four courses were held at Central Community College for both local participants as well as those from across the country.

Overall, the workshops had 132 attendees from thirteen states. Curriculum and trainers were implemented in six community colleges, thirty new courses were developed among these colleges, and dual enrollment programs were expanded. Four community colleges and one high school, each in a different state, have purchased additional mechatronics trainer kits for classroom use. This demonstrates the partnership between the NCNGM and Central Community College project has not only allowed for the dissemination of information, but also the expansion of this model professional development workshop and model curriculum at the national level. Currently, these results are based on the workshop attendees reaching out to the organizers for additional information and mechatronics trainer kits. Beginning with the summer 2023 workshops, participants receive an additional survey approximately ten months after the workshops to determine impacts including if the mechatronics curriculum or pathway were implemented and any enrollment, completion, and workforce data improvements. The project team is also available for additional recommendations for program implementation. From 2022 – 2024 these workshops have served 132 community college and high school educators from thirteen states. Survey data collected and aggregated by the NCNGM's external evaluator reports that 80% of the workshop participants reported high school teachers would benefit from this mechatronics professional development and 93% of the high school teachers report that they don't often have access to mechatronics professional development opportunities.

Overview of the virtual Summer Teacher Workshop

The goal of the Building Career Interest in Computer Science through Advanced Real-World Projects (CICSTART) project is to provide additional professional and technical skill workshops to cohorts of high school students through a five-week Saturday Program. The CICSTART program has provided inner-city students from four high schools with out-of-school, hands-on educational programs focusing on professional skills and engineering technology skills. The program utilizes industry-driven, project-based learning (PBL) and lessons in career and college readiness to prepare students for the workforce. The curriculum is continuously reviewed and modified to address current skills needed by the technician workforce. Each student session consists of five consecutive Saturdays and is taught by a team of high school teachers, community college faculty, and instructors with expertise in professional skills, teambuilding, leadership, coding, CAD software and additional engineering technology skills. From 2020 through 2024, this program has had 196 participants with average participant demographics at 91% from minority populations.

With student feedback being positive, instructors for these programs developed a workshop to disseminate their curriculum through the virtual Summer Teacher Workshop. Annually, the team offers the four-day Summer Teachers Workshop, which brings together high school and community college educators from throughout the United States to experience the same program that is used for the high school students. Curriculum for the workshop, like the student program, is updated annually to address workforce needs trends in a timely manner. The format has remained virtual for four years to accommodate educators from across the nation who have barriers to participating in activities that require travel such as funding and scheduling conflicts.

For professional skills lessons, virtual breakout rooms are used for activities that demonstrate teamwork. For technology skills, supplies are shipped to participates ahead of the workshop for use with instructors in real-time during the workshop. Following the 2024 cohort, 89.5% of participants were aware of careers in manufacturing, 84.3% agreed or strongly agrees that there are many career opportunities available in manufacturing, and 89.5% understand how a product is manufactured.

Both workshops have been able to reach national audiences and provide professional development to educators who may not have local professional development opportunities or funding to be able to participate in other professional development activities. Curriculum has been adapted and developed for use in participants' courses based on lessons learned during the workshops. Feedback for both professional development opportunities has been very positive. Suggestions are taken into consideration and changes are made in the workshops for continuous improvement when appropriate.

Acknowledgments

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References

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