

Micro Nano Technology Education Center

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Abstract: The Micro Nano Technology Education Center is a community college led National Science Foundation Advanced Technological Education Center founded on the idea that by working together to evolve and improve community college micro and nanotechnology technical education programs, we will enhance the quality of education for MNT students who then become higher quality technicians for the MNT industry and skilled technical workforce.

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1. Introduction

Micro and Nanotechnologies have been around for thousands of years. For example, the ancient Egyptians used nano-based silica (sand) in their paints and coatings to get a sheen that has lasted to this very day. Stained glass in the south rose window of Notre Dame cathedral is infused with gold nanoparticles, giving the glass its vibrant color. Although the recipes have been lost over time, the glass crafters of their time knew that if they manipulated certain metals that they could produce beautiful colors. Analysis of these materials from the past, show that nanomaterials have always been prevalent in society and led to modern bottom up fabrication and synthesis techniques to develop new properties of materials. These discoveries have led to advancements in medicine, materials engineering, optics and photonics and a myriad of other areas and provide a framework of modern-day nanotechnology knowledge and applications (**Figure 1**).



Fig. 1. Applications of Nanotechnology

Micro and Nanotechnology is an advanced technology field specifically identified by the National Science Foundation Advanced Technological Education (NSF-ATE) program as one of the key fields that drives our nation's economy. Micro and Nanotechnology are rapidly developing fields that have revolutionized important technologies in medicine, electronics, biomaterials, nanomaterials, integrated photonics, and semiconductor manufacturing. Micro and Nanotechnologists and technicians work in a wide range of industries such as medicine, engineering, photonics, food science, aerospace, defense, materials science, energy, advanced manufacturing and more.

The Micro Nano Technology Education Center (MNT-EC) was conceptualized in 2019 by educators, who specialize in micro and nano education, and was awarded a grant by the NSF ATE program in 2020. The MNT-EC was founded on the idea that working together to accomplish a greater goal enhances the quality of education for students so they may become higher quality technicians. The MNT-EC has four primary objectives including: 1) Developing a coordinated national approach to advance Micro Nano Education (MNT) education; 2) Delivering professional development to enhance knowledge, skills, and abilities; 3) Conducting strategic outreach, recruitment, and retention of traditional and underrepresented faculty/students; and 4) Creating a deep Industry/Education Alliance that supports student success.

In 2020, the MNT-EC began working with the Micro Nano Technology education Special Interest Group (MNT^oSIG) to bring together MNT faculty, industry, and the general public with the goal of getting a cohesive, dedicated community of individuals, business leaders and higher education facilities together to work on a common goal. That goal is to advance micro and nano education through community college led technician education. As part of the mission, the MNT-EC works collaboratively with MNT industry partners through the formation of a Business Industry Leadership Team (BILT), a model developed by the National Convergence Technology Center, that asks active industry engagement in the creation of knowledge, skills, and abilities to be taught in MNT technical education programs. MNT-EC has worked with industry to structure a comprehensive BILT team of members who understand current MNT industry needs across the nation and can assist in guiding curriculum development to match future technology and education advancements. The BILT will allow industry representatives to shape the future of MNT technical training and secure access to the pipeline of highly skilled technicians from community colleges across the country. It will also connect industry directly with educators who are working in MNT technician education. The BILT team is responsible for advocating for the industry needs that will elevate the effectiveness and sustainability of MNT education programs and will work hand-in-hand with members of the MNT-EC to build the vision for the future of MNT education together.

The MNT-EC focuses on educator professional development opportunities in order to grow community college MNT programs and increase the number of community college faculty leading these programs. Professional development covers the wide array of categories included in MNT education, such as Micro Health and Safety, Photonics, Vacuum Technology Systems, Imaging and Characterization, and ancillary topics, such as increasing diversity and equity in MNT. Professional development and outreach are a vital part of creating the cohesive community needed to advance micro and nano technical education.

Partnerships are a vital component within the MNT-EC. Partnerships include other NSF ATE projects and resource centers, educational institutions, nano related organizations, professional associations, and nano related industries (**Figure 2**).



Fig. 2. Micro Nano Technology Education Center (MNT-EC) Partners

The MNT-EC is focused on bringing opportunities to students in micro and nano technical education. Programs provided through MNT-EC that brings this focus to fruition include:

- Organization of the Micro Nano Technology Collaborative Undergraduate Research Network to provide year-long research experiences for community college MNT technical education students.
- Production of the Talking Technicians Podcast to feature stories on different MNT technicians in each episode. They are asked, in a conversation style interview, about who they are, where they come from, how they became interested in MNT and what lead them to their current technician role.
- Providing MNT Co-mentoring alongside Mentor-Connect for faculty to submit NSF MNT ATE grant proposals. Mentors help prospective grantees by sharing successful grant-writing strategies, knowledge, and resources with a goal of developing the next generation of Principal Investigators for the Advanced Technological Education (ATE) Program.

The MNT-EC aims to increase the number of community college faculty in MNT community college technical education. At its core, the MNT-EC will provide community college students opportunities to obtain outcomes in MNT technical education and through partnerships with industry leaders to grow the MNT skilled technical workforce.