How did you become involved with the National Resource Center for Materials Technology Education (MatEdU)? What are its aims and objectives?

MC: I am passionate about promoting hands-on educational instruction in science and technology, particularly in the field of materials science. As a National Science Foundation (NSF) Advanced Technological Education (ATE) centre we have developed MatEdU resources that provide educators with a range of experimental activities in science and technology. The collection largely comprises easy-to-access web-based resources and instructional materials. We also offer extensive professional development opportunities and promote the use of core competencies in materials technology education. The hope is that our efforts and activities will fuel the interest and motivation of students, causing them to consider careers in materials science and technology.

TS: I am Professor Emeritus of Materials Science and Engineering at the University of Washington, Seattle, USA. I have been active in materials research and education at school, college and university levels throughout my 50-year career. I have also served as an invited speaker and author of many scientific and educational articles, a member of the Editorial Board of Journal of Materials Education, and serve as co-Principal Investigator of the MatEdU programme. Ms Cossette, you are the MatEdU Executive Director and serve on the board of the National Coalition of Advanced Technology Centers (NCATC), an organisation that works closely with NSF-funded ATE centres. Why are these centres so vital to businesses and the economy?

MC: The ATE programme focuses on technician education in the high-technology fields that drive our nation’s economy. It promotes partnerships between academic institutions and industry, such as NCATC, in order to improve the education of science and engineering technicians at both undergraduate and secondary school levels.

Are there any skills gaps in the materials technology workforce? How does your programme work to address such issues?

MC&TS: MatEdU reviews the essential skills for technicians in a wide variety of materials-related fields and identifies the core competencies that relate to these skills. We then pinpoint the areas where there are gaps in educational materials and, based on this, we try to find ways to fill these gaps. We focus on developing modules that help technicians understand more about specific materials and how they can be processed for maximum gain.

Why is the education of specialists in materials technology currently an important focus for the centres?

MC&TS: While the general technician can often solve problems related to materials usage, specialists are educated to understand the microscopic structure of materials and how processing can affect properties. This means that they are an asset to design and development teams focused on a specific product.

What types of educational tools has MatEdU developed and how have they made an impact?

MC&TS: We have developed a set of educational modules that provide a solid basis for understanding materials technology at different levels. The modules are all different levels of complexity, including introductory, intermediate and advanced. In addition, we have undertaken a literature review of other modules that are currently available in the full range of materials science areas and, importantly, we have provided access to these modules through our website.

Mel Cossette and Tom Stoebe discuss how their research in materials science and technology education is helping to create a nationwide network of industry and educational experts with a shared goal of increasing the number of highly skilled and work-ready science technicians.
Enterprising education

The National Resource Center for Materials Technology Education, USA, hosts a dedicated team who are aiming to identify, validate and promote the core competencies of materials science technicians. Based on this, they are creating innovative educational resources with a focus on materials science.

IN RECENT YEARS, materials science has come to the fore as one of the most important emerging scientific fields. Drawing on a range of techniques in physics, chemistry and engineering, the development of new materials and applications are creating waves across multiple disciplines, driving advances in nanotechnology, additive manufacturing (AM) and green technologies. Exciting changes are occurring at an increasingly rapid pace, sometimes making it difficult for school and college faculty and technicians in industry to keep well-informed. There is therefore an urgent need for a framework that ensures these faculty and technicians remain up-to-date with the latest developments, enabling them to understand more about the materials they handle on a daily basis.

In response, the National Resource Center for Materials Technology Education (MacEdU) is aiming to drive and promote the education of technicians utilising materials in their work. Funded by the National Science Foundation (NSF) Advanced Technological Education (ATE) programme, the Center’s vision is to position itself at the intersection of industry, education and community and to engage in strategic collaborations that advance materials technology education. Housed at Edmonds Community College near Seattle in Washington State, USA, the Center is currently developing a thriving national network of industry and educational professionals with the goal of increasing the number and diversity of skilled, employment-ready technicians. It provides a comprehensive array of curriculum resources for materials technology, including the latest core competencies. The Center also endeavours to ensure that the skills of technicians are in line with the expectations and demands of employers – an area that is becoming increasingly challenging as new materials and technologies emerge.

By anticipating the current and future knowledge gaps among engineering and manufacturing technicians in the US, the Center disseminates new and important information in these areas, enabling technicians to build a deeper understanding of innovative advances in materials science. “Numerous strategies are used to develop, improve and broaden dissemination efforts, especially through our enhanced website and partnerships with academia, professional groups and industry,” explains Mel Cossette, Executive Director and Principal Investigator for MacEdU. With over 20 years of experience in manufacturing education, Cossette has a wealth of knowledge in the development of technician training programmes in both industry and educational institutions.

A STRONG SYNERGY

Alongside their informative and accessible website, MacEdU educational materials are also disseminated through participation in various high-profile events. One of the most significant events is the annual three-day Materials in Science, Technology, Engineering and Math (M-STEM) Workshop, a unique and practical professional development forum on the theme of materials science and STEM education. Bringing together students, educators and industry personnel from all over the US, M-STEM, previously called the National Educators Workshop, shines a spotlight on hands-on teaching and learning methods: “In the past 25 years, this Workshop has engaged over 7,000 attendees who have participated in over 600 experiments and demonstrations, leading to the awareness that materials and manufacturing is an exciting and viable career option,” Cossette asserts.

MacEdU has delivered a series of workshops at M-STEM that aim to provide educators with the necessary resources to inspire and equip the next generation of technicians. Positive feedback from these workshops demonstrate the incredible scope of M-STEM to grow in both national and international influence. Indeed, the combination of M-STEM’s well-

How important is the provision of educational tools to the creation and preservation of manufacturing jobs in the US?

MC&Ts: While manufacturing is once more growing in importance in the US, many industries have lost their technologists – including technicians, scientists and engineers – to retirement or to other jobs. The education and training of a new group of technologically focused students should provide the means for American industry to expand and become more predominant on the global stage.

What collaborations do you have with industry, community colleges or other partners to develop and disseminate MacEdU’s educational resources?

MC&Ts: MacEdU works directly with industry and educational institutions in the development of its programmes and curricula. Ten collaborating colleges are direct partners in our programme, while many more are included in our national educational projects. We seek advice from industry, universities and national laboratories, whose personnel serve actively on our advisory committees and participate in our workshops and meetings.

How do you see MacEdU’s mission developing or changing in the future?

What new manufacturing practices will technicians need to be educated on?

MC&Ts: The available scope of engineered materials has expanded from metals and plastics to much more exotic materials, including composites and nanomaterials. These materials, along with their many new applications, bring processing methods that require more precise understanding and knowledge. MacEdU will continue to facilitate the dissemination of this knowledge, improving materials science education and enhancing the reliability and performance of manufactured products in the US.

A STRONG SYNERGY

Alongside their informative and accessible website, MacEdU educational materials are also disseminated through participation in various high-profile events. One of the most significant events is the annual three-day Materials in Science, Technology, Engineering and Math (M-STEM) Workshop, a unique and practical professional development forum on the theme of materials science and STEM education. Bringing together students, educators and industry personnel from all over the US, M-STEM, previously called the National Educators Workshop, shines a spotlight on hands-on teaching and learning methods: “In the past 25 years, this Workshop has engaged over 7,000 attendees who have participated in over 600 experiments and demonstrations, leading to the awareness that materials and manufacturing is an exciting and viable career option,” Cossette asserts.

MacEdU has delivered a series of workshops at M-STEM that aim to provide educators with the necessary resources to inspire and equip the next generation of technicians. Positive feedback from these workshops demonstrate the incredible scope of M-STEM to grow in both national and international influence. Indeed, the combination of M-STEM’s well-
INTELLIGENCE
NATIONAL RESOURCE CENTER FOR MATERIALS TECHNOLOGY EDUCATION

OBJECTIVES
To advance materials technology education with goals to provide web-based resources, deliver easy and direct access to classroom modules, offer professional development opportunities and promote the use of a set of core competencies.

KEY COLLABORATORS
National Institute of Standards and Technology (NIST) • National Coalition of Advanced Technology Centers (NCATC) • North Carolina Agricultural and Technical State University (NCAT) Engineering Research Center for Revolutionizing Metallic Biomaterials • National Center for Rapid Technologies • Thomas Nelson Community College • SpaceTEC • Nano-Link • Washington State Department of Commerce • ASTM • SME • Tulsa Technology Center

PARTNERS
North Seattle College • Connecticut College of Technology • Wentworth Institute of Technology • Kettering University • Central Washington University • University of California, Irvine

FUNDING
National Science Foundation (NSF) • Advanced Technological Education (ATE) • NIST • NCAT Engineering Research Center for Revolutionizing Metallic Biomaterials

CONTACT
Mel Cossette
Executive Director
National Resource Center for Materials Technology Education
Monroe Hall/MTST
Edmonds Community College
20000 68th Avenue West
Lynnwood, Washington 98036
USA
T +1 425 640 1376
E mel.cossette@email.edcc.edu
www.materialseducation.org

Mapping the objectives
MatEdU has the following goals:

• To increase access to resources for materials technology education using a widely accessible and up-to-date website
• To build and enhance the Center’s collection of resources
• To broaden and implement a wide set of dissemination strategies
• To implement a long-term and sustainable plan for material technology education

A SHARED PLATFORM
Looking ahead, the team at MatEdU is planning to continue working in close partnership with M-STEM and TEAM and to keep enhancing and disseminating educational resources in materials science and technology. The Center’s activities in this area will contribute to their overarching aim for the future, namely to ensure the consistent knowledge progression and professional development of science technicians, as well as the promotion of the US manufacturing industry at large: “MatEdU’s continual growth, in terms of the programmes it offers and its penetration into the educational market, will broaden and enhance materials education for technologists,” concludes Cossette. “At the same time, it will improve the reliability and performance of manufactured products in American manufacturing.”

Center impacts
Some of MatEdU’s most notable impacts to date include:

• Partnerships with 10 higher education institutions, helping to educate thousands of students in the field of materials science
• The growth of its website database to include over 500 materials science laboratories, modules and papers
• The development and implementation of instructional and professional workshops in materials science
• Collaborations with other National Science Foundation Advanced Technological Centers and projects to generate a prominent national materials science presence
• Cooperation with industry professionals to create advanced study programmes that respond to stakeholder needs
• Involvement in local, regional and national outreach endeavours, which emphasise the necessity of strong materials science curriculums and trained technicians

established identity and wide reach with MatEdU’s innovative educational resources is highly positive for the STEM community at large. Certainly the hope is that this synergy will help STEM educators to broaden their knowledge about materials science and advance their professional development, as well as provide the materials education community with valuable educational aids.

CUTTING-EDGE COMPETENCIES
A further key initiative in which MatEdU is involved is Project Technician Education in Additive Manufacturing (Project TEAM). Working closely with the American Society for Testing and Materials (ASTM), MatEdU and TEAM are compiling a new set of AM core competencies and a curriculum. The primary goals of TEAM are to engage in the early stages of Global AM Standards development by providing technical and educational input and, secondly, to advance AM educational knowledge by translating AM standards into core competencies and integrating these competencies into AM programmes. The hope is that this curriculum will be used across a range of industry sectors and disciplines: “It is the intentional involvement of educators in the development phase of these standards and core competencies that makes this effort innovative,” Cossette states. “The project is strategically designed to accelerate skills development in AM technician education by decreasing the time-lag between Global AM Standards development and their translation into core competencies, as well as fuelling their active integration into the curriculum and their delivery in the classroom.”

The strength of this project lies in its ability to enhance knowledge of AM processes through the development of standardised vocabulary, materials and quality benchmarks. Crucially, the implementation of these standards will help to establish the core competencies needed in technician education, ensuring that the development of Global AM Standards in both industry and education settings will speed up the adoption of advanced AM technologies. In turn, this will drive the growth of these technologies, allowing their use to become more widespread. This further highlights the need to develop comprehensive training programmes for materials technicians that provide them with a solid grounding in this field.

The strength of this project lies in its ability to enhance knowledge of AM processes through the development of standardised vocabulary, materials and quality benchmarks. Crucially, the implementation of these standards will help to establish the core competencies needed in technician education, ensuring that the development of Global AM Standards in both industry and education settings will speed up the adoption of advanced AM technologies. In turn, this will drive the growth of these technologies, allowing their use to become more widespread. This further highlights the need to develop comprehensive training programmes for materials technicians that provide them with a solid grounding in this field.

MEL COSSETTE is the Executive Director and Principal Investigator for MatEdU, Project T.E.A.M. and M-STEM, funded by NSF’s ATE programme. Cossette has over 20 years of experience in manufacturing education, serves on numerous national boards and as an invited Keynote Panelist for the White House Office of Science and Technology Policy STEM Initiative.