



MINNESOTA STATE
Engineering Center of Excellence

Annual Report

FISCAL YEAR 2020

PREPARED BY

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Director of Grants, Evaluation, and
Development

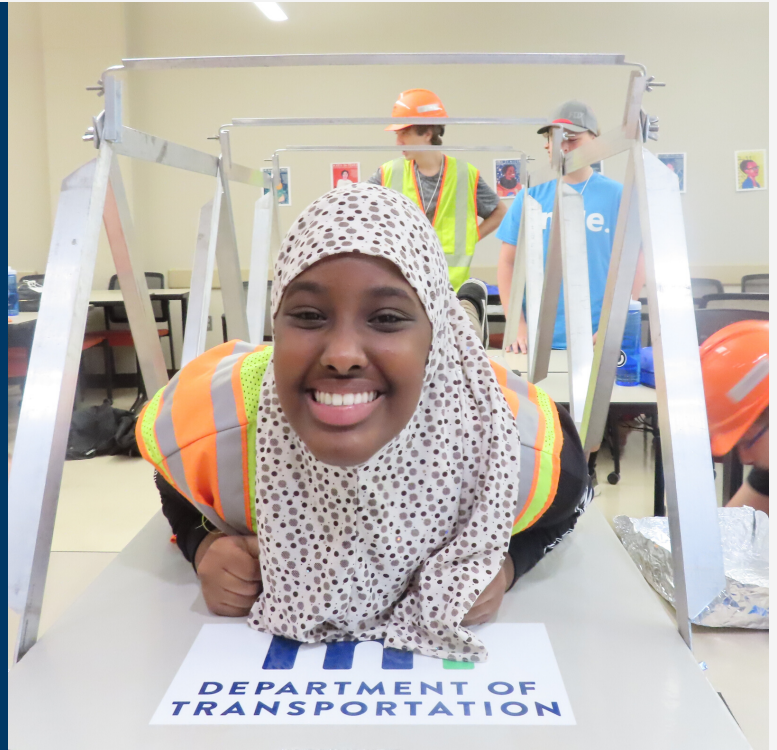
Jason Bruns
Center Director





WHAT WE DO

The Minnesota State Engineering Center of Excellence facilitates relationships by engaging academic institutions with industry and provides educational outreach by inspiring interest in science, technology, engineering, and math (STEM). These efforts shape the next generation of engineers who will solve real-world problems. The Engineering Center of Excellence fosters accessibility to the latest technologies, workforce programs, and post-secondary education. Collectively, advancing Minnesota's engineering innovation and competitiveness by enhancing education, engaging industry and inspiring students.



01

ENGAGE.

[CULTIVATE + ENHANCE + LEVERAGE]

We cultivate relationships and enhance existing partnerships to leverage new resources.

02

EDUCATE.

[THEORY + PRACTICE + REAL WORLD]

We bring together theory, practice and real-world solutions through innovative educational programs.

03

EXPERIENCE.

[LEARN + INSPIRE + LEAD]

We create opportunities to inspire the future workforce and provide thought leadership to industry professionals.

Director's Overview

It has been an interesting year with the pandemic making so many changes to the Minnesota State Engineering Center of Excellence programming in the spring. But, the team found very clever ways to continue supporting the initiatives and create programming that will allow us to reach many more underrepresented students going forward.

During the summer of 2019, the Engineering Center of Excellence provided great camp experiences to students in grades 6-9. They were given the opportunity to take a deeper exploration into many science, technology, engineering, and mathematics (STEM) principles along with career explorations in these fields. These summer experiences were provided by programs like Explore STEM, Explore Engineering and Explore STEM+Ag. It was also at this time the Engineering Center met with its industry-led Advisory Committee. This group is made up of industry and academia support members affiliated with engineering and engineering technology. For the first time, the summer meeting utilized the Open Space Technology meeting process. The reason this unique process was implemented was to provide a much more enriched and fulfilling approach to those who attended versus the traditional style meeting.

The fall of 2019 was a very busy time of year with a variety of activities. This is the time of year the Engineering Center attends many conferences to share with secondary and post-secondary educators and administrators the great opportunities that are available and ways to collaborate with the Engineering Center. We participated in conferences like CTE Works! Summit, Minnesota Conference in Science Education, and Ignite STEM Afterschool, with many of our advisory members contributing testimonials about our programming at the conferences. There were also several career expos that the Engineering Center attended to promote engineering and engineering technology programs to secondary students. Finally, we supported specific programs like Women in STEM Networking Dinner, Engineering and Manufacturing Workforce Partnership Seminars, and Engineering Academic Days for the underrepresented.

As for winter, we met with the Advisory Committee to share some of the outcomes from the previous summer meeting, discuss workforce and education strategic planning and other opportunities that the committee can continue to support. Other activities for the winter included supporting programs like SkillsUSA competitions, MATHCOUNTS Competition, and the Southern Minnesota Regional Science and Engineering Fair. This also begins the Regional Engineering Machine Design Contest season.

Finally, the spring of 2020 brought the pandemic, forcing us to cancel and change some of our events to virtual. A couple of the Regional Engineering Machine Design Contests and the Championship event had to be cancelled. The Engineering and Engineering Technology STEM Teacher Workshop along with several early camps were changed to virtual delivery. The Engineering Center supported secondary and post-secondary educators by hosting regular virtual learning forums and website tools, allowing to share pedagogy, curriculum and a support network.

We have a great team and are proud of our accomplishments, with much more to complete. Going forward, why not join us by being part of shaping the future or helping to open the doors for others?

All of the best,



Target Audiences

College Presidents, Chief Academic Officers, and Deans

Provide strategic communication to increase awareness and perceived value of the Center and encourage administrative support for educator collaboration.

Industry Employers and Associations

Provide thought-leadership and develop partnerships to expand opportunities for students, improve curriculum, and develop pathways into the workforce.

Post-Secondary Educators

Foster collaborations to strategically transform existing curriculum, programs and provide professional development to better meet industry, students and societal needs.

Secondary Administrators, Counselors, and Educators

Identify and develop curriculum, provide educator training and facilitate collaborations to inspire students and increase awareness of career opportunities in Minnesota.

Post-Secondary Students

Create ties between students and perspective employers through internships, capstone opportunities, job shadowing, research and other programs.

Secondary Students

Offer career exploration and skill development programs to increase awareness and interest in engineering, engineering technology, and related career pathways..



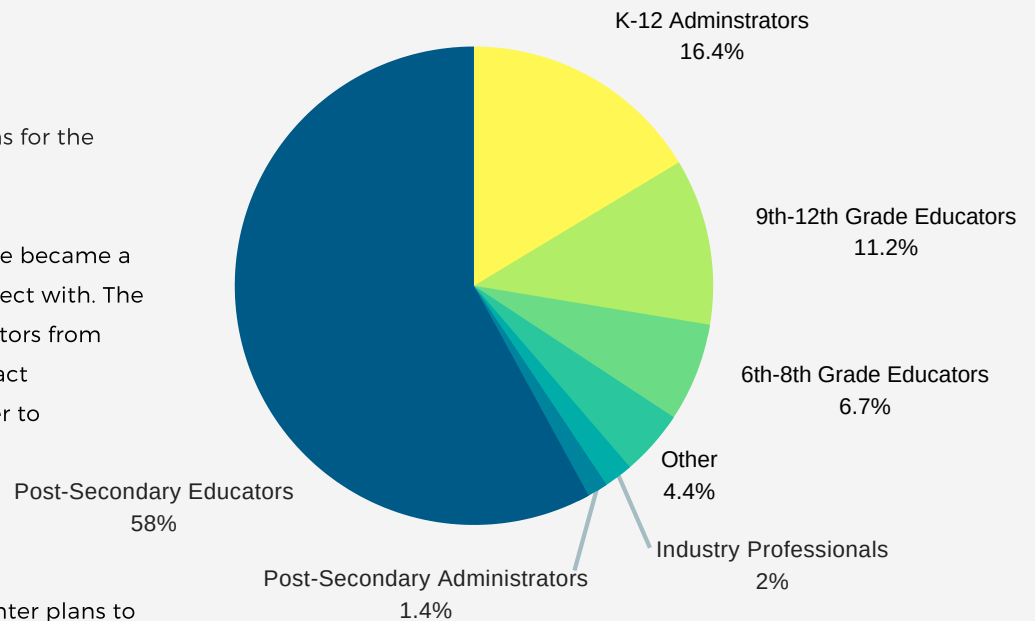
Marketing Revamp

During Fiscal Year 2020, the Engineering Center focused on revising and developing their marketing material and approach. Much effort was placed on:

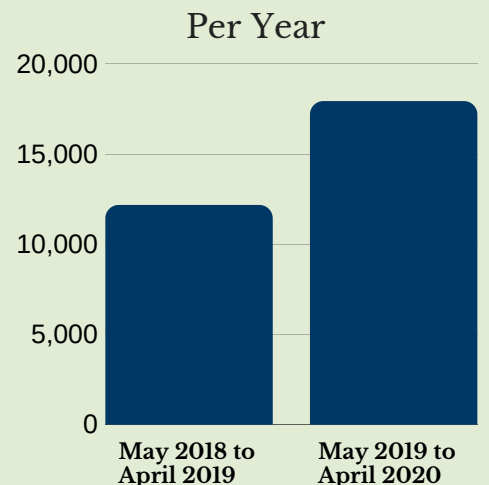
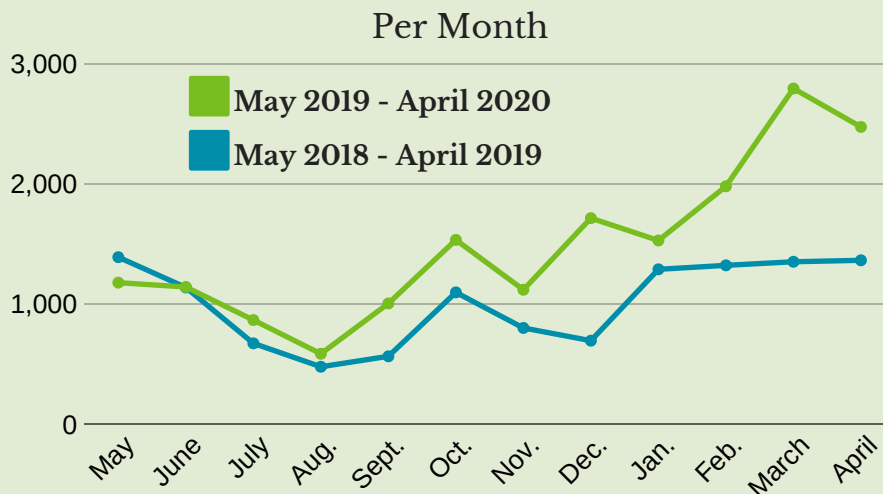
- Developing new marketing material for the Center's new and growing programming.
- Redesigning the website.
- Organizing and managing contacts.
- Developing a quarterly newsletter, and
- Developing email marketing campaigns for the Center's programs.

Through these efforts, the Center's website became a key resource for target audiences to connect with. The website had a 47% increase in unique visitors from May 2019 to April 2020. The use of a contact management software allowed the Center to consolidate all of their mailing lists and be able to more effectively target specific audiences with programming that would be most relevant to them. Moving forward, the Center plans to continue with these marketing advancements.

Active Contacts (N=9,533)



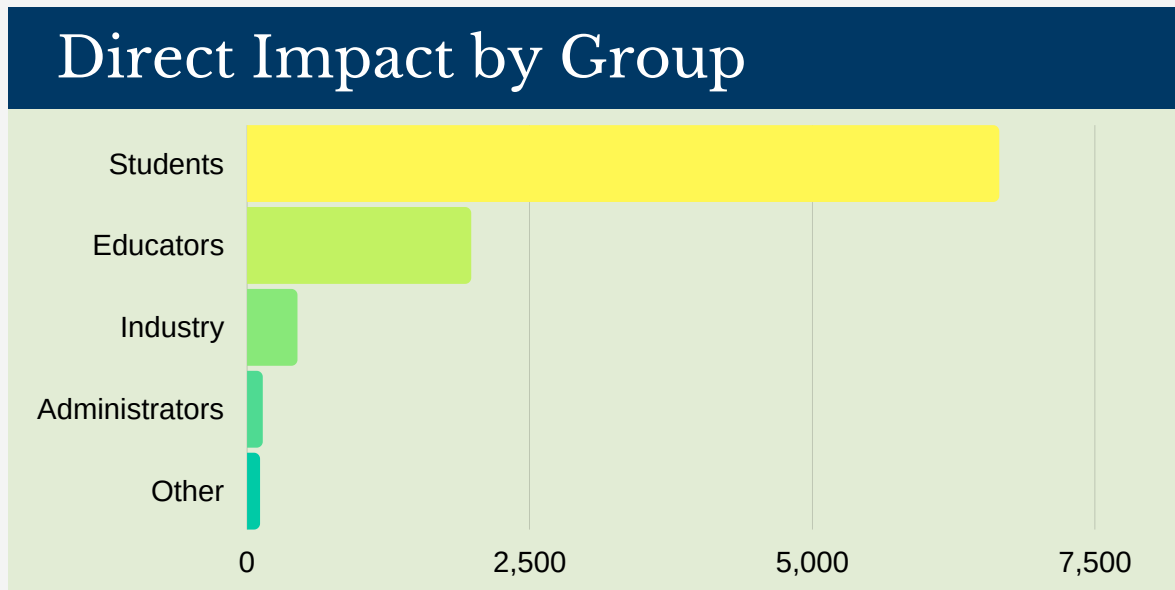
Comparison of Unique Website Visits Per Month and Year



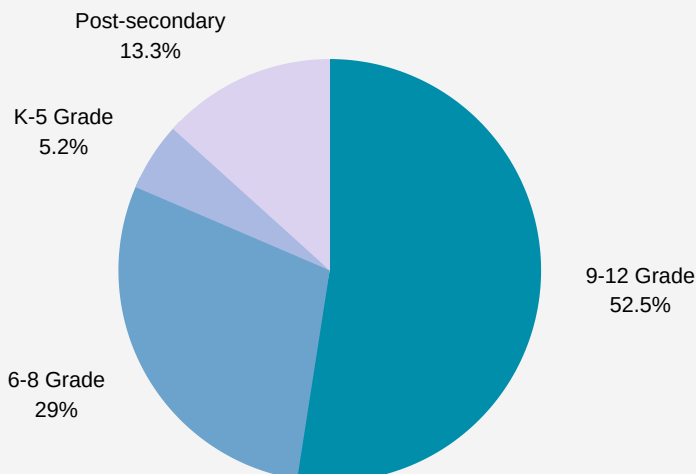
Direct Impact

The next several pages of this report outlines the impact and direction of each of the Engineering Center's key programming areas. Collectively, the programming facilitated by the Engineering Center had a direct impact on over 9,250 students, educators, administrators, and industry professionals during Fiscal Year 2020. These numbers do not capture the indirect impact of the Center's programming. Students were the largest group directly impacted, with 6th through 8th

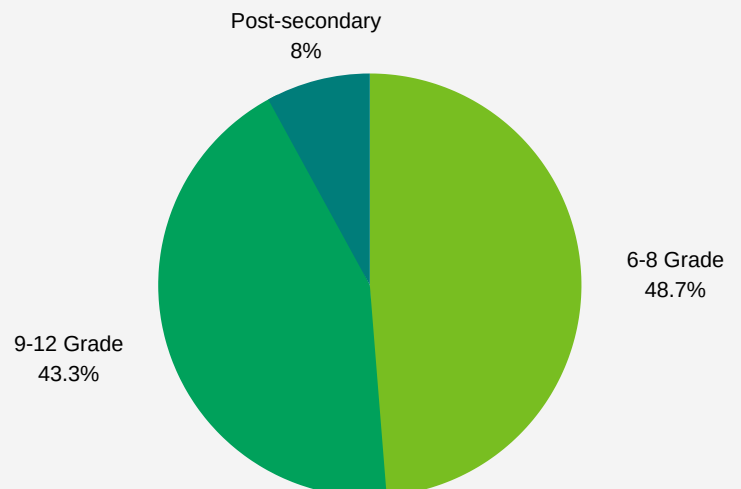
grade (48.7%) and 9th through 12th grade (43.3%) students making of the vast majority of that group. Educators were the second largest group directly impacted by the Center's programming, with 9th through 12th grade (52.5%) and 6th through 8th grade (29%) educators being the majority in that group. As you will read through the next several pages, the Center has experienced excellent growth this year and is strategically planning to continue that growth into 2021.



Educators



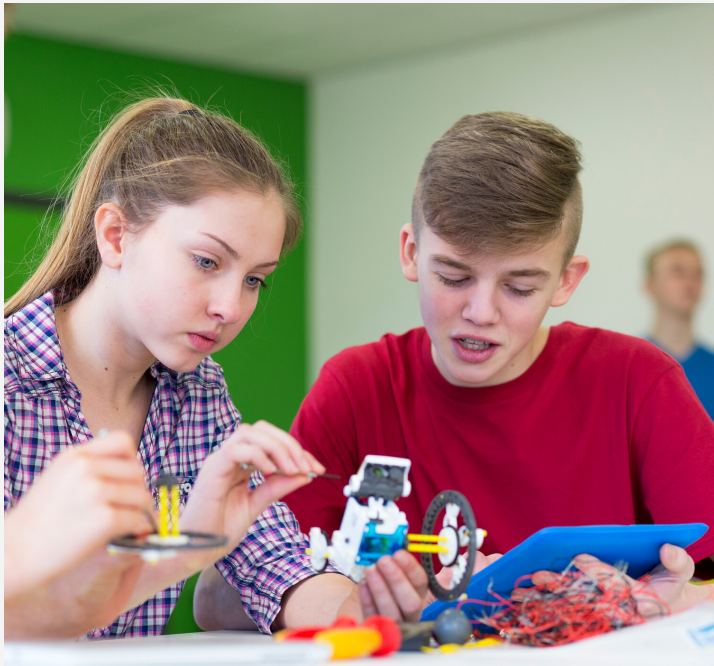
Students



Advanced Career

Advanced Career and Middle Grades STEM are Career and Technical Education Curriculum that contains secondary hands-on team projects allowing teens to test drive careers in high-tech fields while they deepen their understanding of the engineering design process and master essential literacy, math, science and workplace skills that employers' value.

For Fiscal Year 2020, our goal was to have two schools adopt the curriculum program. We are excited to have met that goal with two middle schools looking toward adopting the Middle Grades STEM curriculum. These will be the first schools in Minnesota to adopt the programming! Our hope is for these two middle school to help drive the Advanced Career curriculum into the high schools.



Moving into the new fiscal year, the Engineering Center plans to host the Minnesota Teacher Training Institute for Advanced Career and Middle Grades STEM in Summer 2021. This professional development workshop will prepare educators for implementation of Advanced Career and Middle Grades STEM into their classroom.

Additionally, to support the work of the students and help encourage pursuit of a post-secondary pathway, we will continue to work with colleges and universities to secure credit recognition for those students that have completed Advanced Career pathways. This approach benefits the students with credit for prior learning, provides academic credibility for the program, and provides a pipeline to post-secondary educational institutions.

Highlights



Raised program awareness through speaking engagements with educators, administrators, parents, and industry professionals.

Met Fiscal Year 2020 goal for two schools to adopt curriculum.



Negotiated four (4) college credit recognition with MSU, Mankato Health Informatics B.S. degree program.

Negotiated one (1) college credit recognition with MSU, Mankato Construction Management B.S. degree program.



Explore Engineering

The Explore Engineering program includes various resources that support educators as they work to inspire interest in engineering and engineering-related careers with 3rd - 12th grade students, especially those from under-served populations. The program currently has three developing areas of focus: (1) kits and curriculum, (2) day camp resources, and (3) engineering design challenges.

The kits and curriculum are standards based, designed for 3rd - 8th grade, and suitable for formal and non-formal settings. The curriculum is currently in development in partnership with Minnesota 4-H. This project is funded in part by the Boston Scientific Foundation and the Perrigo Foundation STEM grants and is anticipated to launch in Fall 2020! Through the support of the grant, we anticipate over 30 educators adopting the programming in their classroom during the 2020-2021 academic year, impacting an estimated 3,000 students.

The day camp resources provides the framework for a college to implement their own Explore Engineering Day Camp with the Engineering Center providing advisory support. During the summer 2020, three day camp programs were being planned, however, due to COVID-19 the in-person programming was cancelled. In spite of this setback, two locations made accommodations to offer adapted programming virtually.

The engineering design challenges are also being developed in partnership with Minnesota 4-H. The vision for this project is to develop a series of ten challenges that educators can access online. Each challenge will be designed as an interactive e-learning resource that can be utilized by an individual student or in a group. The full set of ten challenges is anticipated to launch in Fall 2020!

Additional funding to support and further grow the Explore Engineering programs is continually being sought. Future initiatives with this programming will include educator training and development of educational and learning resources for industry partners to effectively connect with 6th - 12th grade audiences.



Engineering Machine Design Contest

The Engineering Machine Design Contest is an opportunity for teams of 5th - 12th grade students to design and build a complex machine using everyday objects with the guidance of a coach. The completed machine will use multiple steps to complete a simple task. Students are able to explore science, technology, engineering, and mathematic (STEM) principles while having fun in a collaborative environment. Each year a competition theme is chosen to guide the machine build and allow for whimsical creativity to flourish. This past year the theme was Space Exploration.

In the program's third year of existence, it grew to four regional sites. Teams showcased and exhibited their machine at a regional contest with the opportunity to advance to the Championship event, which was a new addition to the program this year! The Championship event was planned for May, 2020 in partnership with the Minnesota Twins. However, due to COVID-19 and with great disappointment the Championship event was not able to take place. Despite this unforeseeable setback, the program saw exceptional growth increasing the number of schools impacted by 50% and the number students impacted by 59%.



Interest for this program continues to grow as more entities express interest in hosting a regional contest and teachers and students are excited for the opportunity to participate. Moving into the new fiscal year, the Engineering Center plans to recruit additional regional contest site and increase student participation in the program by at least 25%.

Highlights



Increased Regional Contest Sites from Two to Four.

Increased Number of Schools Participating by 50%.



Increased Number of Students Participating by 59%.

Organized the First Annual Multi-state Championship.



Quotes from the Coach

"It's a great opportunity to make engineering fun and meaningful and helps [students explore] their curiosity."

"The [program] allows students to compete in a different setting than the 'normal' co-curricular activities. I like the team aspect of building, planning, constructing, and problem-solving. I have seen students thrive in this setting when I wouldn't have necessarily known they had these interests or gifts in this particular area of machine design."

Continuous Improvement Initiatives

Continuous Improvement Engineering, sometimes referred to as Lean, is a method for creating a more effective business by eliminating wasteful practices and improving efficiency, organically. It focuses on improving products and services based on what customers value and want. The Continuous Improvement Initiatives program aims to incorporate this process into engineering education curriculum; creating a more effective and efficient workforce.

The primary initiative during Fiscal Year 2020 included an investigation into utilizing Lean Engineering and industry assessment teams to facilitate the upskilling of developmentally disabled individuals in the workplace in partnership with Managed Resource Connections, Inc. (MRCI), and ILPEA Industries, Inc., and Iron Range Engineering. Currently, Iron Range Engineering students are formulating an assessment process as part of their senior capstone project. This assessment process will be pilot tested in the Iron Range Engineering Program and shared in a “train-the-trainer” format to both MRCI and ILPEA.



Advocate

“We truly believe the project you proposed is going to move our mission forward and are excited to pilot.”

Tami Reuter
MRCI Chief Business & Marketing Officer

This initiative is an innovative approach to increase workforce and earning opportunities for this under-represented population utilizing an organic business growth means. It also helps industries meet workforce needs by retaining and increasing the skills of current employees.

Moving forward, opportunities have been identified for utilizing this innovative process across the state for various under-represented populations and industry connections. MRCI has stated an intent to continue utilizing this process with other partner industries for its process engineering growth and expansion.

Workforce Partnership Seminars

The Engineering and Manufacturing Workforce Partnership Seminars take place twice a year and are an assembly of industry, academia and state employees taking an active approach to solving workforce and industry challenges. The vision of this program is to build partnerships that restructure and accelerate the Minnesota workforce education system, meeting workforce demands in manufacturing, engineering and engineering technology.

In September 2019, Jeff Miller, Minnesota State Career Pathway Director, shared how to become involved with local and regional educational partners from secondary to post-secondary through work-based learning strategies. Due to unforeseeable challenges, the Winter 2020 seminar was transited into a facilitated forum where the attendees shared activities, academic programs, and reviewed employment data related to engineering and engineering technology.

Moving into the new fiscal year, the Engineering Center plans to continue to grow this collaborative effort with the Minnesota State Advanced Manufacturing Center of Excellence through the facilitation of a partnership huddle team. This team will seek to secure financial self-sufficiency for the programming and increase participation, especially with industry professionals.

Testimonials

“Great group representing manufacturing. A key group that can make things happen.”

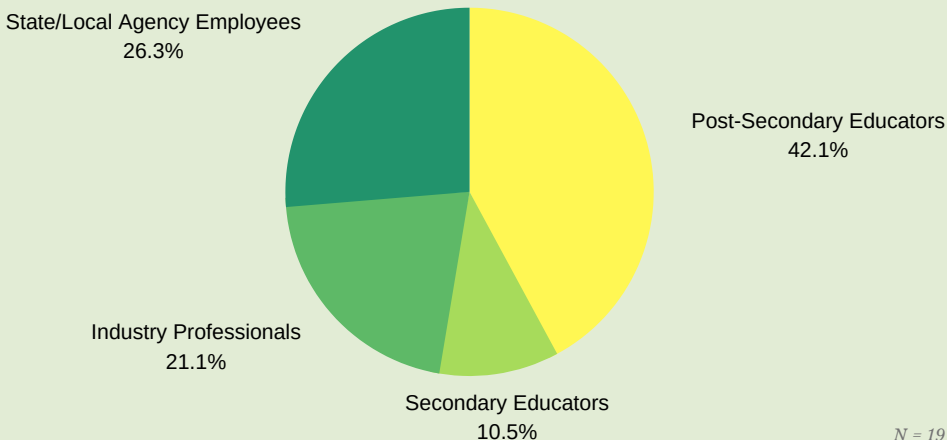
“Met other STEM education and industry cohorts with shared mission, ideas and activities with whom to explore further collaborations.”

“I always find something to take away from the event, new information on available programs, grant dollars, or other mechanisms of funding resources.”

One hundred percent of participants would recommend this program to others.

N = 5

Participants



N = 19

100% Somewhat to Strongly Agreed...

- This program connected the dots of engineering and engineering technology learning through real-world application.
- This program bridged gaps between industry, education, and workforce.
- By attending this program, I gained one or more specific ideas that I can implement in my area of practice.
- The information presented could be applied to practice.

N = 5

Engineering Teacher Workshop

The Engineering and Engineering Technology Teacher Workshop is a professional development opportunity for secondary and post-secondary educators to learn about pedagogically supported foundations for teaching engineering and technology-related techniques. These skills are applicable to all Science, Technology, Engineering, and Mathematics (STEM) educators and help with student retention and success, as well as increasing the workforce in STEM careers.

During 2020, we expanded the program to include secondary STEM educators with the focus of helping them to attract and retain students from under-represented populations in STEM fields. We also initiated a strategic partnership with the Engineering Alliance and an invitation to industry professionals to share workforce challenges in a collaborative forum.

There is excitement among newly developed partnerships and past participants for future engagement and additional opportunities to connect. There is a high level of interest and need for opportunities that bring together industry professionals and STEM educators. Looking forward, support for this program will come from registration fees and industry contributions in order to achieve financial self-sufficiency.

COVID-19 Response

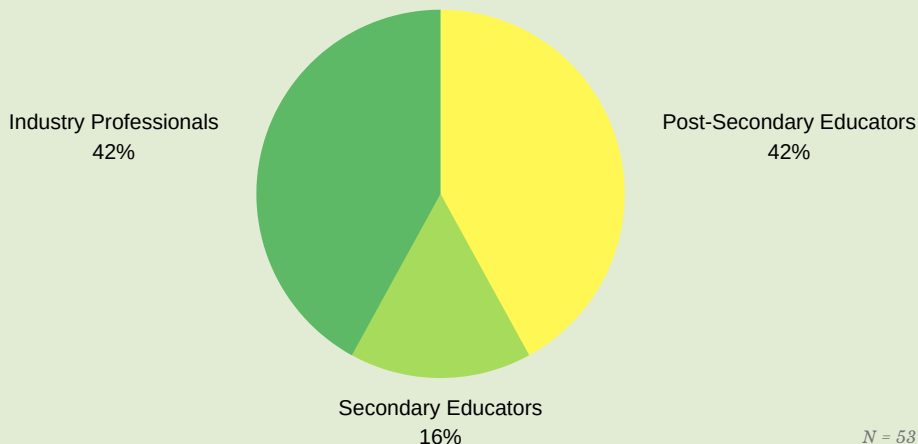
Due to the COVID-19 outbreak, the originally planned workshop had to be modified. For 2020, a shortened 90 minute Zoom meeting was planned: Collaboration between Engineering Educators and STEM Workforce Professionals Workshop. This revised programming was moderated by Joan Carter, engineering faculty at Inver Hills Community College.

What did participants like most?

- *"Innovative presentation style and small group discussions."*
- *"Connecting with educators and industry professionals."*
- *"Interaction between K-12, post-secondary, and practicing professionals."*
- *"Getting new resources for engineering education."*

N = 5

Participants



Over 90% Somewhat to Strongly Agreed...

- This program built awareness and/or connections between education and industry.
- They would recommend this program to others.

N = 30

Engagement Opportunities

TOP 10 REASONS TO ENGAGE

- 1 Invest into the Future Workforce.
- 2 Prepare Students for Careers in Industry.
- 3 Inspire Student Interest in Engineering-related Careers.
- 4 Increase Employability Skills in Students.
- 5 Increase Number of Underrepresented Students Interested in Engineering-related Careers.
- 6 Increase Exposure to Engineering Firm, Manufacturing Facility or Campus.
- 7 Support Educators Preparing the Future Workforce.
- 8 Cultivate Relationships and Opportunities for Collaboration.
- 9 Increase College Program Enrollment, Retention, and Student Success.
- 10 Equip Students with Innovative and Entrepreneurial Mindset.

WAYS TO ENGAGE!

	Advanced Career Curriculum	Engineering Machine Design Contest	Engineering and Engineering Technology Teacher Workshop	Engineering and Manufacturing Workforce Partnership Seminars	Explore Engineering Programming
Provide Sponsorship or In-kind Support	✓	✓	✓	✓	✓
Provide Expertise, Mentorship or Present to Secondary Students or Educators	✓	✓	✓	✓	✓
Host or Organize an Event	✓	✓	✓	✓	✓
Provide Facility, Lab or Campus Tours to Secondary Students, Educators, and Others	✓	✓	✓		✓
Promote Pathway and Recruitment into Careers or Post-secondary Programs	✓	✓			✓
Promote STEM Careers to Underserved and Underrepresented Populations		✓			✓
Volunteer as Judge, Coach, or in Other Capacities		✓			✓
Network with Industry Members and Educators			✓	✓	

Industry and Academic Advisory Council

INDUSTRY ADVISORY MEMBERS

Bob Kill, *President and CEO, Enterprise MN*

Fletcher McNair, *Productive Maintenance Coordinator, Coldspring USA*

Jaci Dukowitz, *Chief Operating Officer, Ultra Machining Company*

John Froehlich, *Director of Process & Technology, EI Microcircuits, Inc.*

Kurt Korkowski, *Senior Systems Engineering Manager, Seagate Technology*

Les Engel, *President, Engel Metallurgical Ltd.*

Scott Grossbauer, *Director of Hydraulics, Donaldson Company, Inc.*

Steve Kalina, *Executive Director, Minnesota Precision Manufacturing Association*

Tom Jamar, *Retired President, Jasper Engineering & Equipment*

ACADEMIC ADVISORY MEMBERS

Aaron Budge, *Acting Dean, College of Science, Engineering and Technology, Minnesota State University, Mankato*

Amanda Robinson, *Advanced Manufacturing – Customized Training, Hennepin Technical College*

Cary Komoto, *Dean, Science, Technology, Engineering, Math & Education Division, Normandale Community College*

Debbie Belfry, *Director of Career and Technical Education, Bloomington Public Schools*

Elaina Bleifield, *Vice President for Academic and Student Affairs, Anoka Technical College*

Dr. Robert P. Fleischman, J.D., *Associate Vice-President, Strategic Partnerships – Customized Training, Minnesota State University, Mankato*

Jeff Miller, *Career & Technical Education Pathways Director, Minnesota State*

Thomas Norman, *Dean, University Extended Education, Minnesota State University, Mankato*

Travis Thul, *Dean of Trade and Technology, Minnesota State College Southeast*

Xi (Leo) Wang, *Masters Student – Electrical Engineering, Minnesota State University, Mankato*

Meet the Team



JASON BRUNS, BSME, MBA

Center Director



MELISSA HUPPERT, PH.D.

Director of Grants, Evaluation, and
Program Development



MOLLY ENGBRETSON

Administrative Assistant

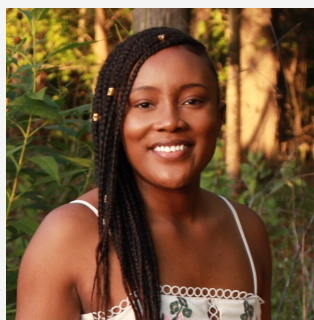
Student Workers



JONATHAN TRZEPKOWSKI

STEM Outreach Graduate Assistant

Degree Program: M.S. in Experiential Education, MSU - Mankato



MARY SIKULU

Undergraduate Office Assistant

Degree Program: B.S. in Science in Aviation,
MSU - Mankato