ENGAGING INDUSTRY. ENHANCING EDUCATION. INSPIRING STUDENTS.

Annual Report

FISCAL YEAR 2022

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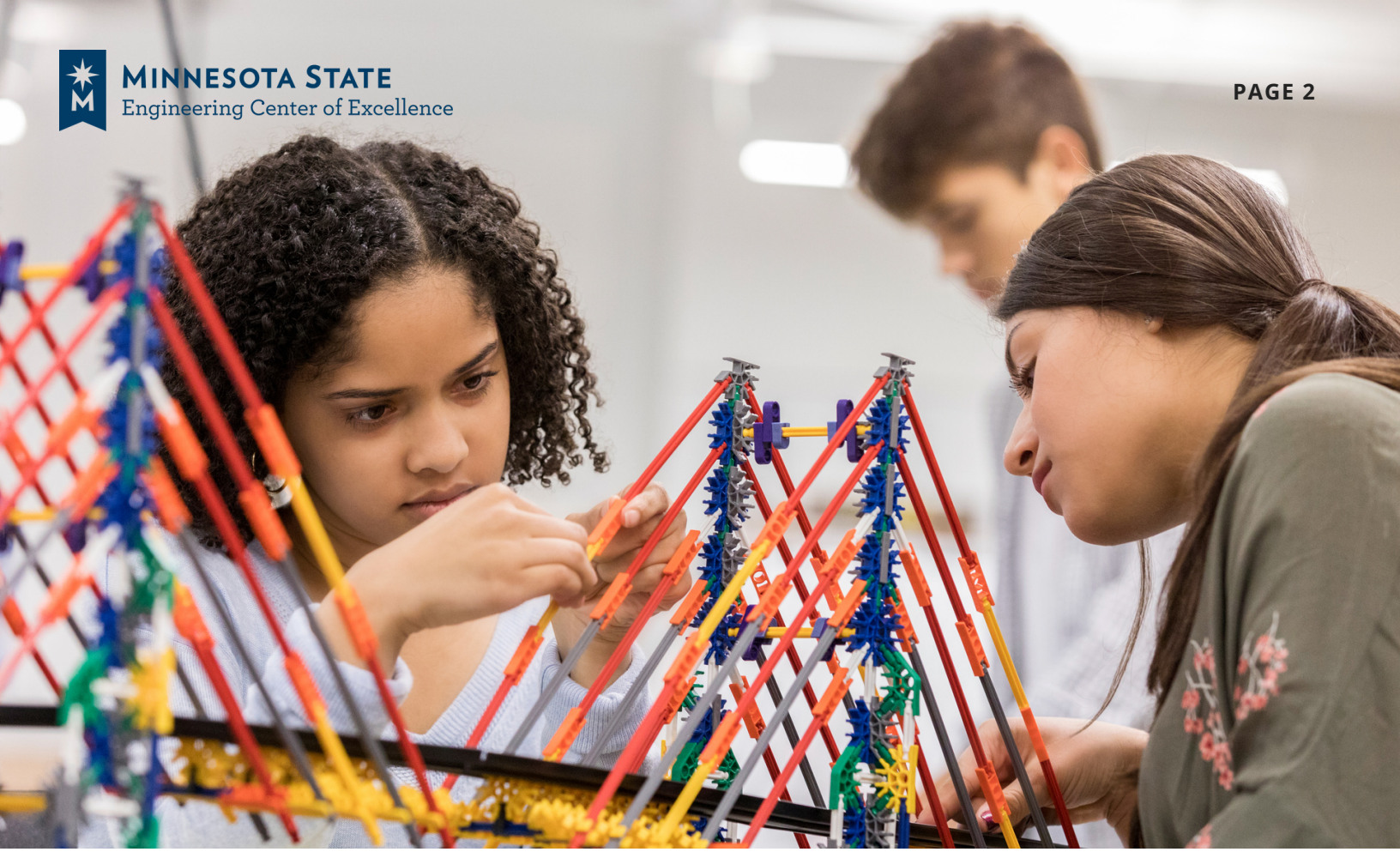


WHAT WE DO

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

What a year that we had. Due to COVID, it felt like we were riding in a car that was running out of gas. We would surge forward, then slow down, and then speed up again. But through it all, the Minnesota State Engineering Center of Excellence continued to make progress with new partnerships and program expansion.

During the summer of 2021, the Engineering Center was provided the opportunity to help deliver three in-person camps for 6th-9th grade youth. At these camps, students are provided career exploration experiences and industry tours. We want to empower them to see and understand what types of careers are available and help them find what might interest them.

Our industry-led Engineering Center of Excellence Advisory Council meeting was held during the summer of 2021. This was in a hybrid fashion at Normandale Community College and the council is comprised of a mix of industry and academia members. In this year's event, we added training about having equity-mindedness in an advisory committee meeting. This tool helped the team move forward to create the Engineering Center's next priorities. The members of our council are leaders in their respective fields and continue to provide great direction and support for the Engineering Center. They have a vision and are willing to contribute where they can. We are lucky to have individuals like this connected with our organization. We met again and continued our conversation in the winter of 2021 when we had to do it virtually.

The team has another exciting and busy year ahead of us. We have taken on many new initiatives along with expanding other programs. Much of this growth work is done through meeting exciting people at conferences as an exhibitor and/or a presenter. There we share our portfolio of engineering resources that have been vetted and are often free or of low cost. They are looking for engineering and engineering technology resources and we are proud to supply them. We also enjoy getting ideas for new resources, so feel free to contact us with other ideas. We are constantly trying to be innovative.

The center is excited to participate in various conferences and serve on engineering and engineering technology advisory committees throughout the state. We are proud of our service in supporting other organizations by serving on their advisory committee meetings.

Currently, we serve on a secondary career pathway, secondary/post-secondary academic and student career and technical student organizations, 2-year college programs, 4-year university programs, MN STEM Ecosystems, and other industry advisory committees. This is our opportunity to listen, learn, share and support engineering and engineering technology throughout the state.

We have a great team. Come be part of it. Help us shape the future and open more doors of opportunity.

All of the best,

Jason Bruns

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 Channels

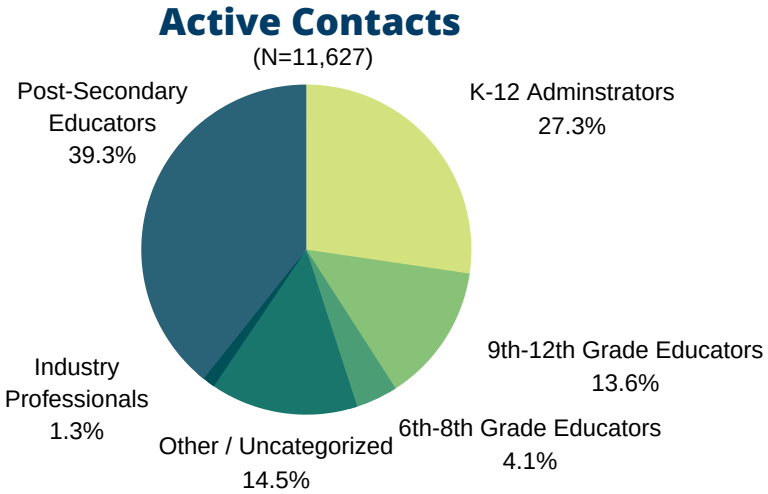
The vast majority of the Fiscal Year 2022 outreach was conducted in online settings. As such, the Minnesota State Engineering Center of Excellence continued to refine its digital marketing efforts with a focus on:

1. Website resource development,
2. Refinement of the quarterly newsletter and program-specific marketing campaigns, and
3. Refining the approach to social media channels with a focus on Facebook and LinkedIn.

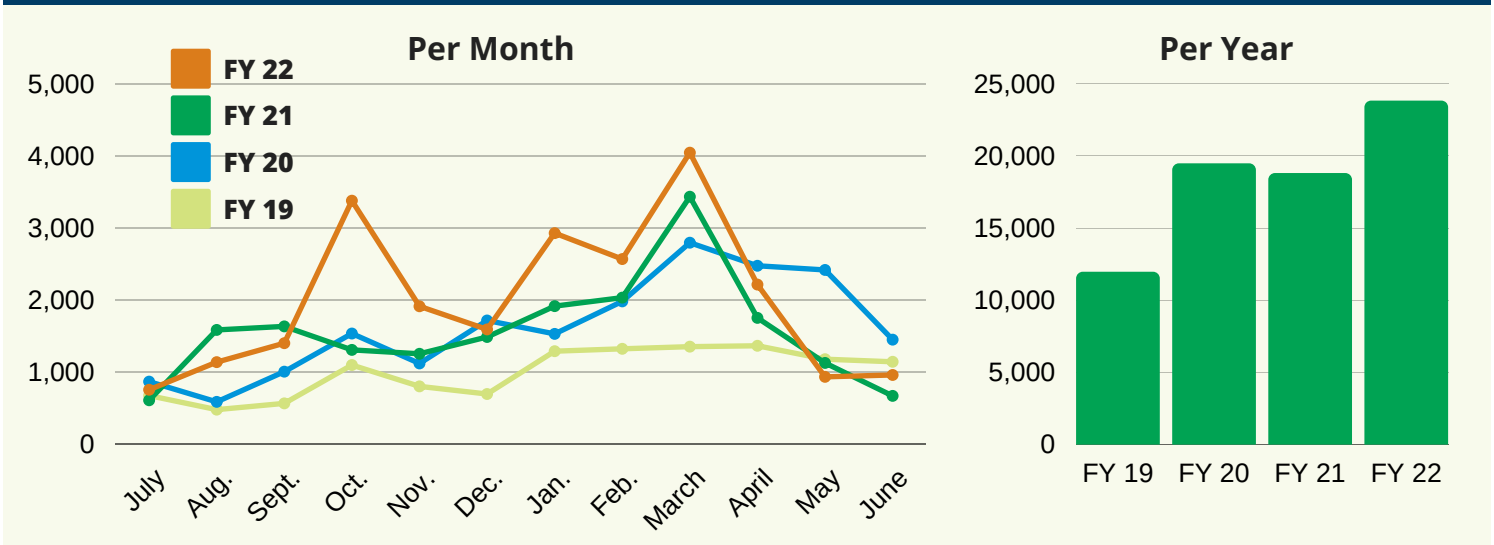
The use of email campaigns to directly target audiences and direct them to the center's website was the most impactful means of marketing. The overall email open rate was 40% and the click-to-open rate was 6% - both above industry averages. The majority of program-specific email campaigns had open rates of 50-80% and click rates of 10-50%. The use of email campaigns is a vital marketing strategy for the center. The center's list of contacts increased by nearly 21%.

The Minnesota State Engineering Center of Excellence website continues to increase in the number of unique visits. The Engineering Machine Design Contest accounted for over 50% of site visits, followed by the home page (8.7%), Reverse Engineering Challenge (5%), STEM Educator Workshop (3.6%), and Workforce Partnership Seminar (3.2%).

The center's social media pages had some growth. The Facebook page reach increased by 42.1% to 5,384 with key events being Engineers Week and the Engineering Machine Design Championship. This was the first year the center had a presence on LinkedIn and Instagram. There is a strong opportunity for growth to connect with industry and education professionals on LinkedIn.



Comparison of Unique Website Visits Per Fiscal Year



Direct Impact

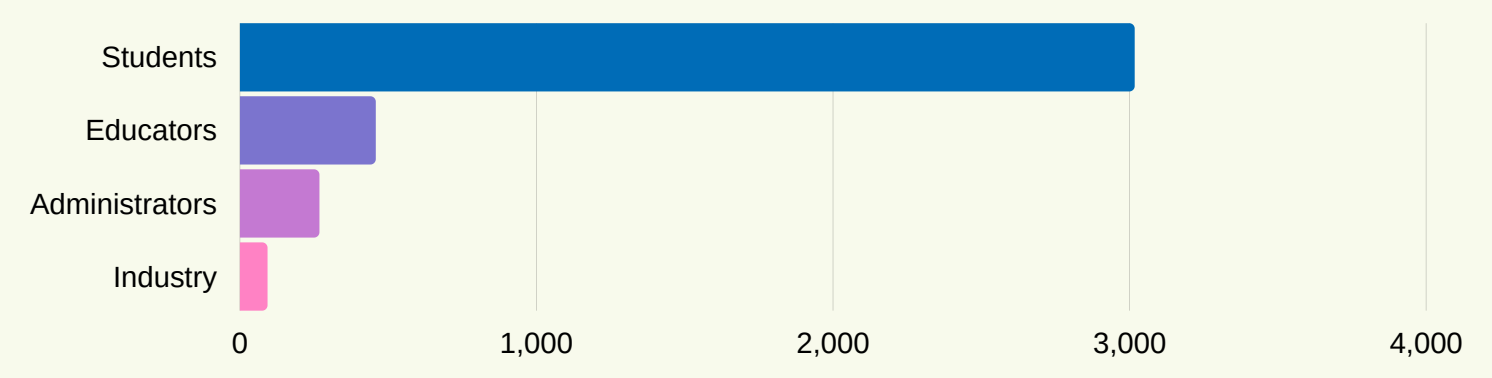
During the past year, the COVID-19 pandemic continued to impact the number of individuals the center was able to engage with. Many events and programs did return to in-person delivery.

Engagement with school administrators increased by 96% and 210% in FY20 and FY21, respectively. This increase is reflective of the prioritization of promoting center programs and resources to school administration and leadership in an effort to expand reach and increase capacity by empowering schools and educators with the center's tools.

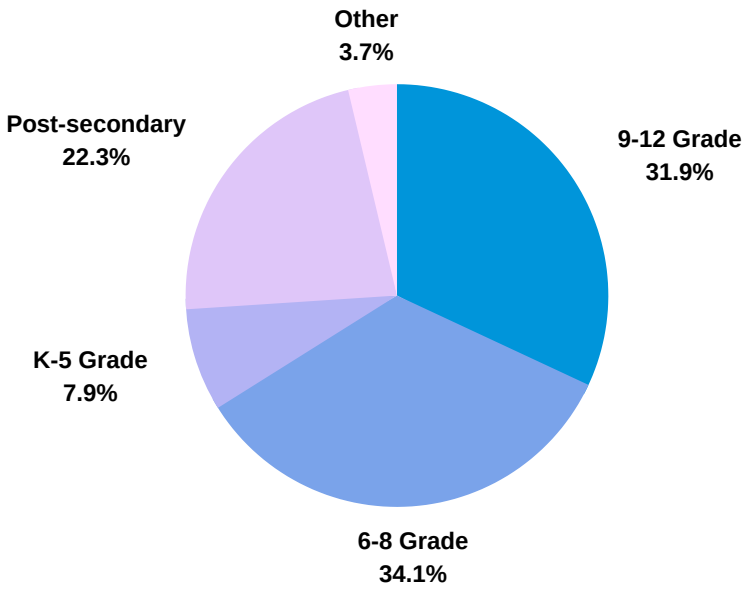
Student outreach and engagement in the center's programs increased by over 700% from FY21 but remained significantly lower (55%) than in FY20 (pre-pandemic). Reach with 9th-12th grade students was 67.4% of all student engagement, compared to 43.3% in FY20.

Looking toward FY23, the center is excited about strategic program growth. The next several pages of this report outline the impact and future direction of key program areas.

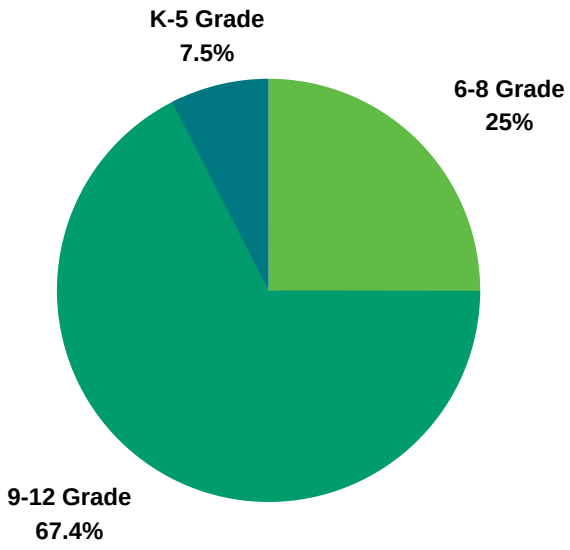
Outreach and Program Reach by Group



Educators



Students



Key Program Areas

The Minnesota State Engineering Center of Excellence aligns its work and initiatives in three key program areas: Explore Engineering, Project/Problem-based Curriculum, and Professional Development. These key program areas were identified as strategic ways for the center to fulfill its mission and align with the **Minnesota State Centers of Excellence Common Strategic Directions**:

ENGAGING INDUSTRY

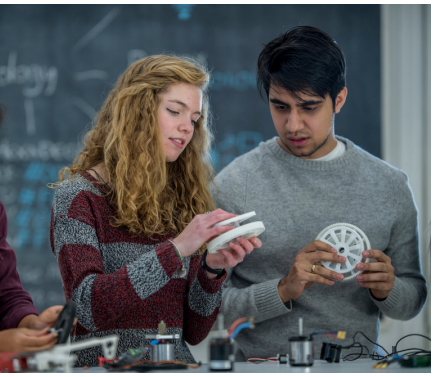
Seeking the voice and expertise of industry and community partners is integral throughout the work of the centers. Centers facilitate **rich**, **interactive networks** to inform and guide our workforce of the future.

ENHANCING EDUCATION

Centers will be a catalyst and conduit for the latest industry knowledge to benefit our faculty and staff and to provide students with an **innovative**, **high-quality** education.

INSPIRING STUDENTS

Centers will provide high school and college students with opportunities to **meaningfully expand their knowledge** of careers and acquire skills and knowledge for their chosen profession.



Key Program Areas

Explore Engineering

The Minnesota State Engineering Center of Excellence is committed to providing free or low-cost experiential-based programs and curricula explicitly designed with the needs of Minnesota K-16 educators and future workforce demands in focus. Taking into consideration project/problem-based curriculum and resources already available to educators, the Engineering Center strives to develop new programs that reduce barriers to access and participation while filling the gaps not addressed by other resources.

Project/Problem-Based Curriculum

The Minnesota State Engineering Center of Excellence values high-quality curricula which allow students to acquire relevant skills and industry pertinent knowledge through project/problem-based curricula. We vet and endorse curricula that inspire student career exploration and emphasize engineering investigation as a means to an end, not to an end in itself. The Engineering Center is committed to facilitating dual credit opportunities with its endorsed curriculum.

Professional Development

The Minnesota State Engineering Center of Excellence regularly provides professional development opportunities for K-16 engineering and STEM educators, stakeholders, and the workforce. These opportunities help to bridge the gap between K-12 and college/university educational offerings, industry trends, and workforce needs. It is through these efforts that learners will be provided with the most innovative, relevant, and quality education possible.

Siemens STEM Curriculum

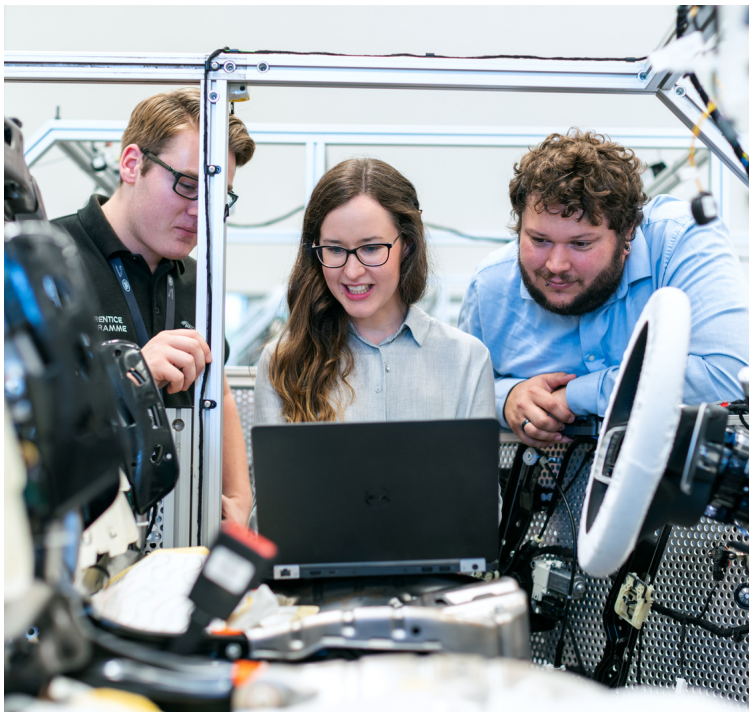
KEY PROGRAM AREA: PROJECT/PROBLEM-BASED CURRICULUM

The Minnesota State Engineering Center of Excellence has teamed up with the Siemens Corporation to share their secondary Siemens CTE curriculum. This free secondary school curriculum is an engineering project/problem-based learning curriculum which teaches the fundamentals of engineering design and manufacturing along with the enabling engineering technology, e.g., CAD, CAM, CAE, design collaboration, etc. There are three year-long courses that build upon each other: Engineering Design, Manufacturing and Automation, and Mechatronics and the Internet of Things (IoT). This curriculum addresses the smart manufacturing era called Industry 4.0, which is the next industrial revolution.

There are currently about 250 schools across the nation that have taken advantage of this curriculum with two of those schools being Minnesota. Teachers and schools interested in this curriculum can send their teachers through the summer Siemens teacher training and access the free CAD and curriculum for implementation in their classrooms.

The center has currently secured two Siemens CTE Curriculum Master Teachers in Minnesota. With these educator resources, we look toward supporting a cohort of teachers being trained in Minnesota in the summer of 2023. Graduate-level university credits are available to teachers who complete the training.

The plans for the Siemens CTE curriculum in Minnesota are to double the number of schools that currently participate in the Siemens program. We also look toward expanding our post-secondary credit recognition for students who have completed this curriculum from two academic institutions to four institutions.



An educator from Waseca, Minnesota was interviewed by Regional Nine Development Commission and stated:

"We have decided to participate in the Siemens STEM curriculum for a couple of reasons. First is the sense that this model of STEM/Engineering curriculum fits well with the manufacturing environment in our community. We have several manufacturing businesses in our community, and it is felt that this curriculum will fit well with the makeup of our community. A personal professional goal of mine is to collaborate more with the businesses in our community. By offering courses that align more closely with the manufacturing base here in Waseca, we can hopefully bridge the gap between school, industry, and careers. The second reason is that this is a cutting-edge curriculum that is being developed by industry leaders in STEM and especially engineering."

Explore Engineering Resources

KEY PROGRAM AREA: 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. There are a few initiatives currently in the development or pilot phase.

The **Explore Engineering kits and curriculum** are standards-based, designed for 3rd - 8th grade, and suitable for formal and non-formal settings. The curriculum was developed in partnership with Minnesota 4-H. The first cohort of educators received their kits and access to the curriculum in the late winter of 2022. One educator stated: "The lessons are so well crafted; it's obvious a lot of thought and time was poured into them. Kids will love this and teachers, too! Students thrive when they have time together in open-ended, hands-on activities... Thank you for sharing these resources. Students will greatly benefit from these activities."

An unexpected outcome of the Explore Engineering curriculum was the development of several **educational card games** designed to inspire interest in engineering and an introduction to primary concepts such as the engineering design processes, engineering notebooks, and engineering disciplines. These games are being piloted with the Explore Engineering curriculum, as well as stand-alone activities through the center's outreach efforts.

Several resources developed during the pandemic are undergoing a review and revitalization process. As the needs of educators are continually adjusting, the resources provided by the center need to be able to stand the test of time. The **STEM Educators Database** and the **Engineering Design Challenge** modules are in the process of being updated and more relevant

for both online and in-person educational settings. Additionally, the integration of new automation technology is underway to ensure a more user-friendly experience and timely gathering of evaluation data.

Another resource in development is the **Minnesota Engineering and Engineering Technology (MEET) Recruitment Cards**. This deck of cards will feature the MEET programs available through Minnesota State Colleges and Universities, as well as highlight important career information such as salary, education requirements, and key traits. This deck of cards will have gameplay instructions and be used as a tool for increasing awareness of MEET program and careers in a fun and simple way.

The center continues to support summer camp programs and seeks to refine a partnership-based framework that can be implemented across Minnesota State.

A focus for the next year will be to seek funding to support the development of resources that will help support industry outreach to young people.

EMDC and REC

KEY PROGRAM AREA: EXPLORE ENGINEERING

The **Engineering Machine Design Contest** (EMDC) 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 mathematics (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 Power the World: Engineering Energy.

With a return to in-person activities, EMDC contests were in full action with a total of seven regional contests, 75 teams, and 342 students - over double the numbers from the previous year. The Championship event included 28 of these teams and an estimated 450+ students, coaches, and spectators in attendance. It was hosted at the Minnesota State University, Mankato Field House.

In the fifth year of the program's existence, major accomplishments included the addition of a new regional contest (Winona State University), the development of a custom tabulation system, the commitment of a corporate platinum sponsor (Seimens), and the formation of an advisory committee made up of team coaches, contest organizers, and judges.

As interest in the program grows, the focus for the 2023 season includes working with regional contest organizers to strengthen their existing program, developing educator/coach resources, and refining the program marketing plan.

The **Reverse Engineering Challenge** (REC) was a new initiative this year and began as an opportunity for students to engage in a same-day engineering contest, with no prior

experience or preparations required. During the REC, teams of 2-5 students are given an item that they must disassemble and identify at least one technology or aspect that could be used to solve a given challenge. Teams are evaluated on their teamwork, presentation, and proposed solutions

The first REC was organized in conjunction with the EMDC Championship event. A total of 127 students participated in this inaugural event. The event was highly rated by educators/coaches. One coach stated: *"The Reverse Engineering Contest was a wonderful experience for our high school students. With a low floor and no ceiling, students of all abilities and backgrounds were able to engage and have fun. It provided a glimpse into the world of engineering beyond our traditional classroom walls, and connected students to future educational opportunities that they had never considered before."*

Based on feedback from the first event, a modified version is planned for Aug. 22 at St. Cloud State University in conjunction with the MN 4-H Engineering Design Challenge event. Additionally, a project-based activity version is being piloted in summer camps at Anoka Technical College and Minnesota State Mankato.

The long-term goal will be to provide a suite of resources that educators can implement and adjust accordingly for their setting, whether it be as a REC project or competition.

MEET Constortium

KEY PROGRAM AREA: PROFESSIONAL DEVELOPMENT

The Minnesota State Engineering & Engineering Technology Consortium (MEET) is a collaboration among Minnesota state engineering and engineering technology faculty. This group works towards building a shared vision for strengthening Minnesota State Engineering and Engineering Technology programs through innovation, partnership, and mutuality. This is an opportunity for two and four-year programs to increase mutual awareness, build relationships and facilitate collaborations among each other.

There are approximately eight two-and four-year institutions represented by faculty that participate in scheduled engagement events. They share programming and collaboration opportunities that are of interest to the faculty members.

A primary focus for this year was the implementation of a one-day conference featuring an industry-based keynote speaker who spoke about competitive collaboration. Based on data from a post-event program evaluation, all respondents (n=7) strongly agreed they would recommend this program to others.

Attendees found great value in the networking opportunity and look forward to future meetings and initiatives.

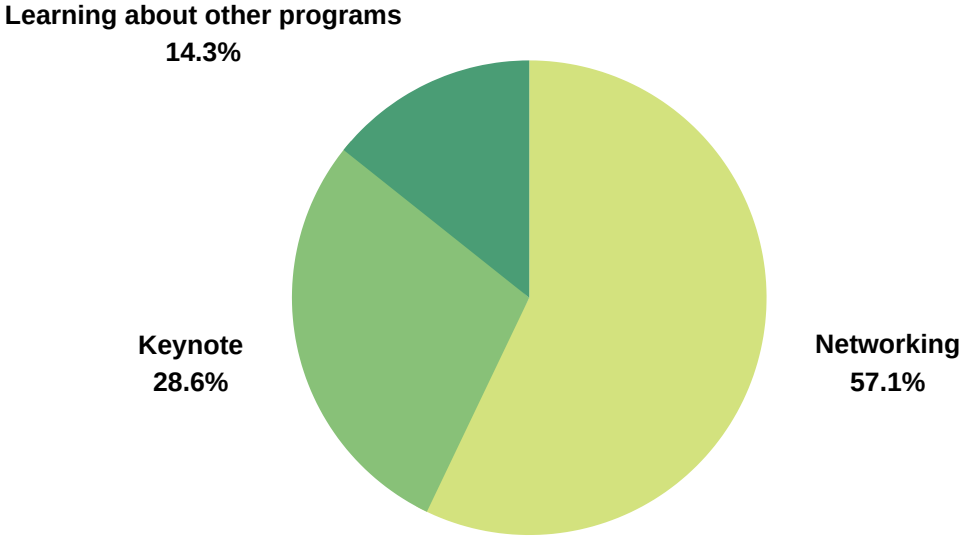
"This session generated a clear drive to have the Minnesota State system drive a unified engineering education marketing focus. Following through on this would be the greatest assistance to all participants."

~ Conference Attendee

"This conference exceeded my expectations, and I am glad that I attended. I see a continued focus on networking and system-wide initiatives for engineering education as a key priority going forward."

~ Conference Attendee

What did you like most about the MEET Conference?



Moving forward, the plan is to grow the consortium to include an additional four institutions. We will continue providing programming that is faculty pertinent, promotes program growth, and provides solutions for student retention.

Workforce Partnership Seminars

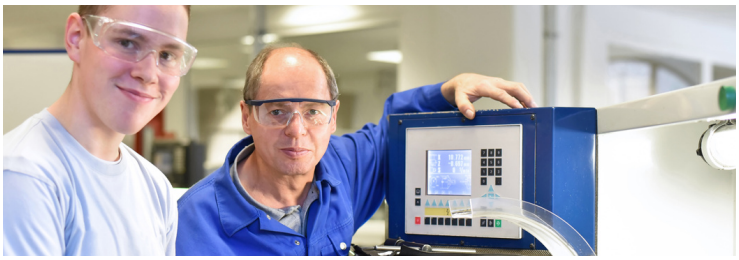
KEY PROGRAM AREA: PROFESSIONAL DEVELOPMENT

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 the fall of 2021, a panel of experts from the Department of Employment and Economic Development and RealTime Talent shared current workforce needs and employer best practices for employee attraction and retention. Then, in the winter of 2022, members of the Minnesota Department of Corrections shared about “Incarceration to Employment: Leveraging this Skilled Workforce”.

Attendees shared how they found value in this program.

"The program sessions provide important career information and advancement opportunities in different fields." **~Winter Seminar Attendee**

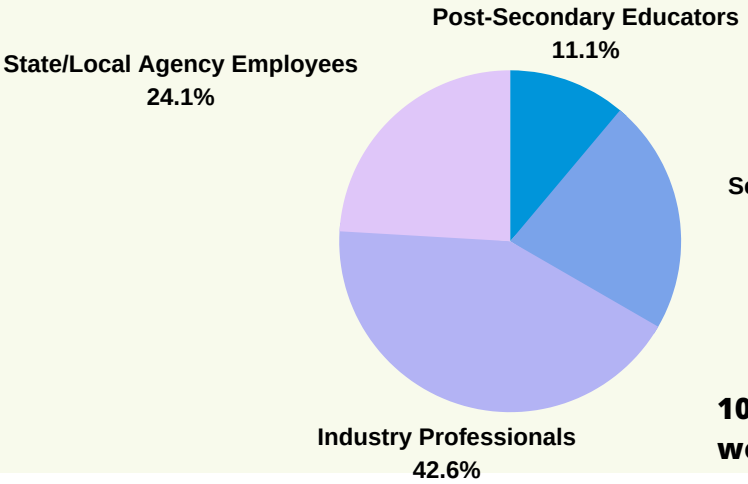


"The presentation brought together many voices with extensive pragmatic life experiences in industry and education as to where and how will future employees be found to fill this big initiative." **~Fall Seminar Attendee**

"I found the panel to be informative in regards to the perspective from labor and industry. It's helpful too as a teacher to know what employers are looking for when we are trying to place our students within labor and industry." **~Fall Seminar Attendee**

The center plans to continue to grow this collaborative effort with industry, educational, and professional association partners. We will work towards continuing to offer free professional development, in a hybrid delivery, providing relevant topics for the workforce and industry challenges.

Participants



85% (or more) Agreed this Program...

- **Connected the dots of engineering and engineering technology learning through real-world application.**
- **Bridged gaps between industry, education, and workforce.**
- **The information presented met their expectations**

100% of program evaluation respondents would recommend this program to others.

STEM Educator Workshop

KEY PROGRAM AREA: PROFESSIONAL DEVELOPMENT

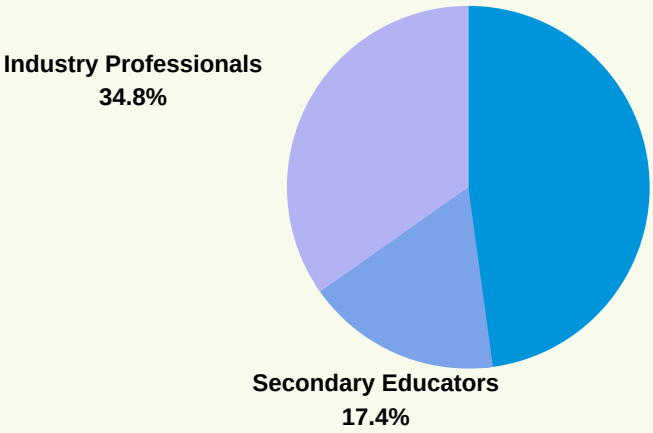
The Engineering and Engineering Technology STEM Educator Workshop is a professional development opportunity for secondary and post-secondary educators to learn about pedagogically supported foundations for teaching engineering and technology-related techniques. These skills apply to all Science, Technology,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

In the fall of 2021, the faculty from the Vacuum Technology program at Normandale College shared their “Strategies for Teaching Technology through Telepresence for STEM Workforce Preparation.” During the winter 2022 event, we had engineering faculty share their contributions that they were sharing at the American Society of Engineering Education.

One industry professional from the fall seminar shared that "*the STEM Educator Workshop illustrates the cutting-edge technology that students are exposed to and how those experiences are preparing them to be the future innovators and leaders that the industry seeks.*"

The center looks forward to continuing to supply free professional development to STEM educators, assisting them by improving their pedagogy and student retention through pertinent topics. This next year, we will look forward to expanding the topics to some unique areas that can connect with more STEM Workforce Professionals in assisting them in achieving their required professional development.

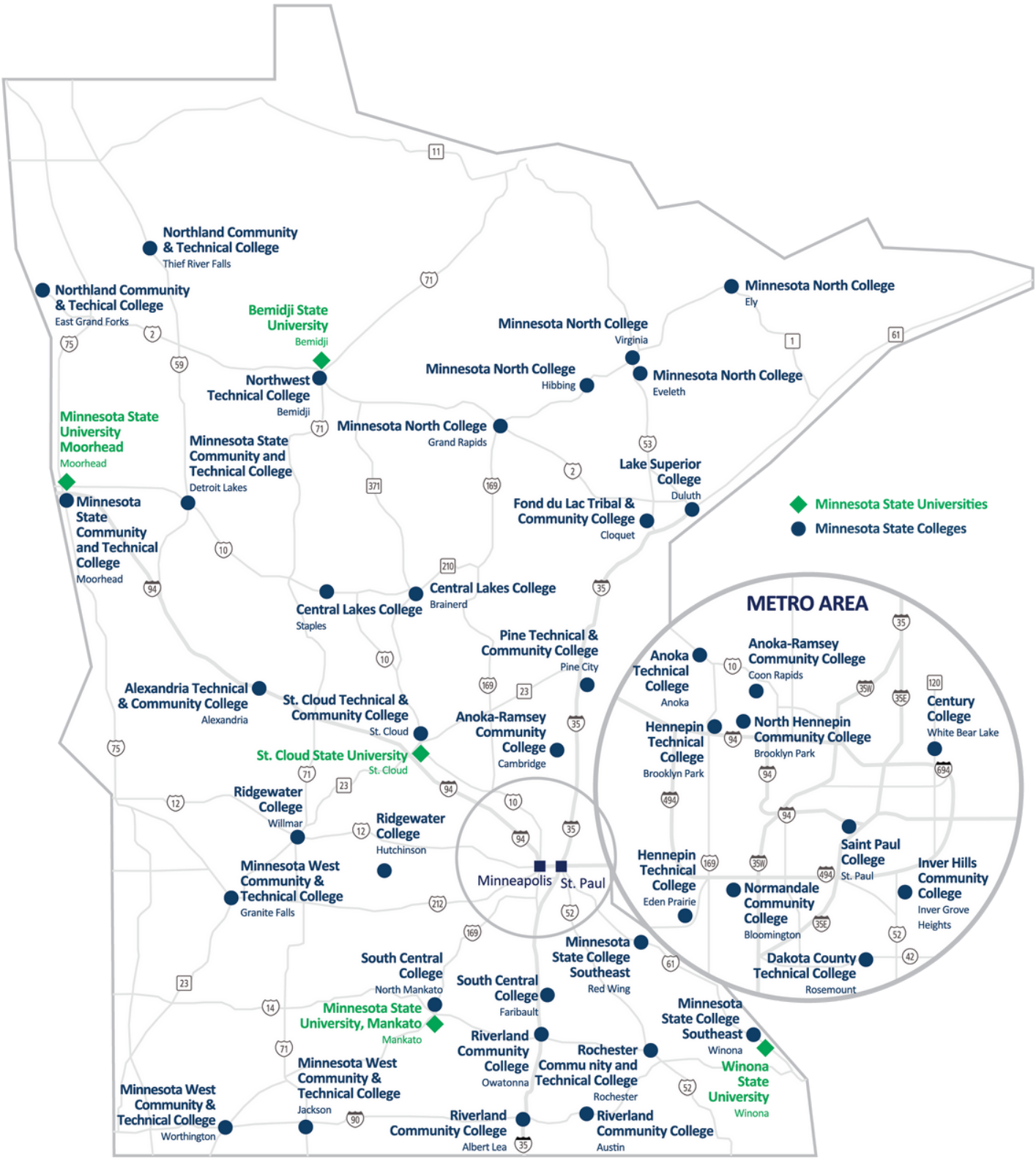
Participants



100% of participants would recommend this program to others.

100% Agreed this Program...

- **Built awareness and/or connections between education and industry.**
- **Connected the dots and enhanced the quality of engineering and engineering technology education and real-world application.**



ENGINEERING & ENGINEERING TECHNOLOGY PROGRAMS

MINNSTATE.EDU/CAMPUSESPROGRAMS

The Team

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STEM Outreach Director

Mary Sikulu
Undergraduate Office Assistant

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Fletcher McNair, *Productive Maintenance Coordinator, Coldspring USA*

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

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

Kwaku Ofei-Budu, Jr., *Senior Supervisor of Warehousing & Inventory, Abbott*

Les Engel, *President, Engel Metallurgical Ltd.*

Nathaniel Smith, *Process Control Engineer, Cambria*

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

ACADEMIC ADVISORY MEMBERS

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

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*

Joan Carter, *Department Chair of Physical Sciences, Engineering, and Technology, Inver Hills College*

Matthew Feuerborn, *Dean of Instruction (Technical Programs), Ridgewater College*

Michael Compton, *State 4-H STEM Director, Center for Youth Development, University of Minnesota*

Molly Schaefer, *Director of Polytech Operations, Minnesota State University, Mankato*

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			✓	✓	