UNITING OHIO'S STEM EDUCATION AND WORKFORCE

Developed by:

The NewGrowth GROUP

TIES
Uniting Partners. Transforming Learning.

INTRODUCTION

This document is intended to provide a framework for integrating workforce development and STEM learning. This framework presents strategies that STEM Ecosystems and other agencies and networks that support STEM education and workforce development can consider for how to organize a shared agenda to build a system in which students can develop and hone their STEM learning, skills, and knowledge in ways that are directly aligned with the needs of the labor market. Each section of this resource reviews actions and considerations for each actor within a collaborative system that supports the integration of STEM education and workforce development. The sections review strategies for integration, a self-assessment for practice and reflection, and an example from Ohio. The last section provides an overview of collaborative networks supporting STEM can embed equity into their practices and actions.

What is STEM?

The Ohio Department of Education defines STEM education as a learner-centered approach to teaching that provides students with a problem-based, transdisciplinary, and personalized learning experience. STEM education uses the foundational practices and skills essential to the core disciplines of Science, Technology, Engineering, the Arts and Humanities, and Mathematics. These essential skills challenge students to think critically, design solutions, and make evidence-based explanations through real-world authentic learning experiences.

Why is this important?

For the students...
Integrating STEM Education and Workforce Development creates meaningful ways for students to engage with employers and community partners- building a student's STEM knowledge and skills while preparing them for the workforce. When done well, this integration creates excitement among students for potential occupational or career opportunities; prepares the next generation of workers before they graduate; streamlines career support efforts already underway; creates a quality framework for engaging with youth in STEM experiences that are equitable, experiential, accessible, and connective; gives industry access to a new talent pipeline; boosts postsecondary attainment rates in STEM fields; and gives back to the community.

For the workforce...
STEM jobs and career opportunities are growing at an exceptional rate. It is estimated that there will be 1,000,000 new jobs in Science, Technology, Engineering, and Manufacturing and other similarly related sectors in the next decade in Ohio. Additionally, this staggering estimate does not include career fields and job roles that require STEM competency at non-STEM companies (such as an analyst at a publishing company), or industries which are STEM aligned such as agriculture. With this in mind, it is critical that our Business, Industry, and Community Organization leaders and hiring managers take an active role in engaging our student population to ensure a sustainable pipeline of STEM-trained future employees.

GUIDANCE FOR STEM LEARNING ECOSYSTEMS, OSLN HUBS, AND STEM NETWORKS

At the systemic level, STEM Learning Ecosystems and other STEM Network Leaders, such as Ohio STEM Learning Network Hubs, are uniquely positioned to bring together multiple stakeholders to help the integration of workforce and education. Three strategies have been identified to support this integration: aligning education/training providers and community-based organizations; interfacing directly with employers and industry; organizing a systems change agenda

Aligning education/training providers and community-based organizations- these strategies support organizations who prepare, place, educate and train students.

- Facilitate conversations to identify areas of duplication and how to bring partners into alignment.
- Support guided pathways in STEM which help students gain stackable credentials and credits along their education and training journey.
- Support programs that meet people where they are, but acknowledge that education and training is the route to career advancement.
- Support STEM learning programs that blend work-based learning with traditional classroom education.
- Support comprehensive support services, especially transportation and counseling.

Interfacing directly with employers and support initiatives which help employers change practices.

- Provide guidance to employers on how to navigate the education system to effectively plug-in and partner with educational institutions.
- Participate in business advisory councils, business-led collaboratives, and/or industry-sector partnerships.
- Build capacity to overcome business reticence through outreach and adapt to programs to fit business needs when possible
- Support learn and earn opportunities in STEM which support the student as they are moving through the program, improving retention and completion- proving the value of investing in training and development of employees to businesses, which helps with deeper engagement and helps attract more employers.
- Support "the middle"- which is the year or two that it takes to prove an ROI of a new program or strategy to businesses. This support helps employers adopt and implement new strategies with lower risk, which builds trust and creates deeper partnerships.

Organizing Systems Change Agendas: These strategies focus on changing the way key stakeholders in a community interact to create better outcomes for companies and students.

- Invest in learning communities that help community-based and business partners become informed and trained on new models- key activities include professional development and technical assistance.
- Invest in research and evaluation to prove that STEM learning strategies and programs work.
- Provide leadership around the development of policy agendas that support STEM learning at local and state levels, including convening, reports, and communications.
- Provide leadership within the philanthropic and funder community - lead and/ or deeply engage in collaborative initiatives which support STEM
- Identify thought leaders in the community and leverage their momentum.

Self-Assessment:

Do you have any of these integration points for Workforce and your network?
- Convening regular meetings to bring together representatives from K-12, higher education, business and industry, and community-based organizations to discuss how to better support STEM learning
- Including industry and employers in governance structures which support STEM
- Provide guidance to partners on how best to navigate a partnership with a school district
- Aligning activities with industry needs
- Engaging industry and employers in STEM activities and efforts
- Participating in Business Advisory Councils
- Partnering with Career-technical Education providers
- Ensuring instructors are aware of industry trends and standards
- Providing instructors with externships and professional workshops- especially those offered by local industry
- Providing STEM career information and resources to students and families
- Providing STEM career-exploration and work-based learning opportunities for students

Does the collaborative support any Quality Career Exploration and Work-based Learning?

- **STEM summer camps-** STEM summer camps are out-of-school time programs that provide students the opportunity to engage in depth in STEM content and aligned activities.
- **After School STEM programs/clubs-** STEM after school programs and clubs meet at a regular frequency and have STEM curriculum and experiences that scaffold- helping students achieve a deeper understanding of the content.
- **STEM career library-** A STEM career library is a collection of resources including videos, audio recordings, one-pagers, and posters that feature community members talking about their STEM career pathways
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- STEM career-focused competitions- Career competitions expose students to STEM career pathways and engage them in a rich learning environment where they can explore their interests and passions.
- **Client-focused projects-** Client-focused projects provide students with opportunities to design solutions to authentic client-focused problems. The problem or task should involve designing a product, service, system, or planning and staging an event. Learners should have access to tools and technology necessary for solving the problem or completing the task. In designing the problem or task, the employer should be prepared to share an overview of their business and an introduction to career pathways or careers that would help solve these problems or complete these tasks
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- **Summer jobs-** Summer jobs are paid opportunities that allow students to experience the workplace environment, demonstrate key professional skills such as reliability, work ethic, punctuality, teamwork and discipline during their summer break.

Story from the field

The Center for Youth Futures strives to integrate the roles of several efforts to promote STEM education in the region: SW Hub of Ohio STEM Learning Network, Greater Cincinnati STEM Collaborative, Believe in Ohio, and the SW Ohio Science and Engineering Expo. The Greater Cincinnati STEM Collaborative works hand-in-hand with OSLN in its mission to create a robust, equitable STEM (Science, Technology, Engineering and Mathematics) pathways to meet the accelerating demand for science, math, and technical careers in our three-state region. The Greater Cincinnati STEM Collaborative brings education, community, and business partners together to provide rich STEM learning experiences for our students. These experiences are proven to grow student interest in and confidence to pursue STEM careers. For over a dozen years the Greater Cincinnati STEM Collaborative has worked with teachers and dozens of schools. For instance, the Greater Cincinnati STEM Collaborative has brought 3D Printers Clubs and STEM Bicycle Clubs to thousands of students. In this after-school format students learn and invent, draw, and fabricate using 3D printing technologies. In the STEM Bicycle Club students, working with mentors, take apart and re-assemble bicycles to study each component system and to learn about engineering and manufacturing.

GUIDANCE FOR LOCAL SCHOOL DISTRICTS

STEM education creates meaningful pathways to post-secondary success for K-12 students through partnerships and career exploration with community entities. It goes without saying that local school districts are the most important touchpoint for STEM education and workforce integration. To establish this integration schools may consider the following strategies: establishing curricular connections with business and industry; partnering to enhance opportunities for practical and real-world experiences; and engaging with STEM-rich formal and informal learning experiences.

Establish Curricular Connections with Business & Industry, providing opportunities and access for success in college and career such as:

- Provide business and industries concierge-like services to help them understand how to navigate the education system to effectively partner to provide opportunities and experiences for students.
- Support Career-Technical Education alignment through engaging Business Advisory Councils and following best practice guidance from ODE
- Establish career-aligned curriculum and resources through inviting business partners to review course materials and share career pathway information
- Create opportunities to partner with employers to help students earn Graduation Seals. The state created 12 diploma seals for students to demonstrate academic, technical and professional readiness for careers, college, the military or self-sustaining professions. Seals help students develop an array of critical skills that are valuable to them as they transition to the next steps after high school. Schools should consider encouraging students to pursue seals that meet their individual interests and skills.
- Create opportunities to help students earn industry-recognized credentials- invite feedback from industry to learn which credentials are most valued and explore opportunities such as pre-apprenticeship programs where students can earn the credentials.
- Support dual-enrollment/ College Credit Plus opportunities for students through partnering with local community colleges or four-year universities.
- Support work-based learning experiences such as internships, apprenticeships, pre-apprenticeships and job shadows. Explore options for integration with curriculum and course work.

Create Meaningful Partnerships with Business, Industry, Community Organizations, and Institutions of Higher Education that provide and enhance opportunities for practical and real-world experiences.

- Invite partners to be involved in schoolwide decisions in a leadership capacity.
- Explore opportunities for partners to potentially provide financial support, materials, or other goods and services to STEM learning experiences.
- Explore opportunities for partners to provide learning spaces, out-of-school opportunities, or sponsor other initiatives that support STEM learning experiences
- Explore opportunities for partners to provide in-kind support, such as voluntary labor, including:
  - Speakers
  - Curriculum feedback or design
  - Providing authentic problems for students to solve
  - Acting as authentic audience to assess student work and provide feedback
  - Mentors during project completion and experts during learning experiences

Engage students in STEM-rich formal and informal learning experiences with the community that are personally relevant to students.

- Work with partners to build community-based and supported STEM experiences which align to classroom learning, standards, and outcomes.
- Work with partners to create community-based STEM experiences which are student-driven and are aligned with student interest and motivation
- Engage directly with community organizations and experts outside the school to plan and implement community experiences connected to STEM learning.
- Work with partners to build community awareness of opportunities to engage in STEM learning and experiences and mitigate barriers to participation

Self-Assessment:

Does your school provide career exploration for your students?
- The school provides a central point of contact for partnership opportunities for career exploration
- The school provides age-appropriate opportunities for applied learning in professional STEM careers to all students.
- The school provides age-appropriate opportunities for STEM business and industry awareness and exploration to all students.
- As appropriate for grade level, all students' career interests are developed through active student involvement in STEM activities such as researching, shadowing and mentorships and for high school students, apprenticeships and internships.
- For high school only: Mentorships, apprenticeships, and internships have clear expectations communicated to both students and to partner hosting the student.
- For high school only: The school provides access for students to complete certifications, credentials and/or credit completion at community colleges, colleges and/or universities.

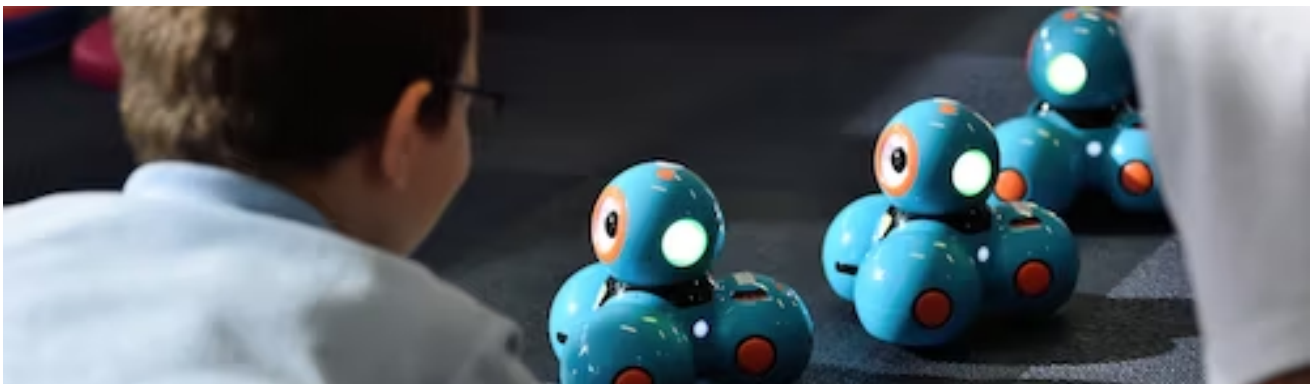**Does your school have established partnerships with institutions of higher education and businesses?**
- Partners are able to seamlessly plug into school activities and know what is expected of them to provide a quality experience for students.
- Business and Industry partner(s) serve in a leadership capacity to influence schoolwide decisions.
- High education partner(s) serve in a leadership capacity to influence schoolwide decisions.
- Partners support instruction by providing ideas for design challenges and problem-based learning.
- Partners share resources with the school, including but not limited to lab/design space, mentors, speakers, equipment, current industry information, expertise, and meeting facilities.
- When age-appropriate, students have opportunities to participate in STEM-related competitions, on-site/online STEM exhibits, and/or in local, state and national STEM forums.
- For high schools only: Partners provide opportunities for work-based learning development, assisting in credential alignment, etc.

Does your school engage in relevant STEM-rich community experiences?
- Schoolwide, students are provided with STEM-focused community learning experiences, relevant to both students and to the community.
- Students and teachers partner with community members to enhance learning experiences.

Does the district support any Quality Career Exploration and Work-based Learning?

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Story from the field

The Cleveland Metropolitan School District (CMSD) and Cleveland Foundation partnered to launch the Planning and Career Exploration (PACE) initiative. PACE is embedded curriculum that provides all CMSD 6th – 12th graders with the knowledge, skills, experiences and confidence to uncover the occupations or careers they want to pursue, via a variety of quality in-school lessons, career advising and relevant out-of-school experiences.

"Creating this pipeline will benefit both our graduates and the region," said Eric Gordon, CMSD chief executive officer. "We want all of our students, whether they go to college or not, to find and thrive in living-wage careers that match their strengths and interests. And employers need qualified candidates to fill in-demand jobs."

PACE's planning process was a collaborative effort involving more than 100 individuals, 40 organizations and 70 employers. Its aim was to develop a guidance and support system — integrated early on into the structure of students' educational experience — that promotes career awareness and provides work-based learning opportunities that are commensurate with students' interests, needs and abilities. The overall goal is to ensure all CMSD students graduate from high school with a career goal and a roadmap to achieve it.

GUIDANCE FOR INSTITUTIONS OF HIGHER EDUCATION

Institutions of Higher Education should engage business and industry partners on an ongoing basis to ensure that the program design, work-based learning opportunities, and curriculum content they offer will effectively prepare their students with requisite STEM knowledge, skills, and competencies. Providing opportunities for faculty and program staff to interact with company HR, training, and supervisory associates assures open communications that can be beneficial as workforce needs change. This can lead to a continuous improvement practice that facilitates adjustments in program content, structure or format when needed. Institutions that had staff identified as a primary representative and point of contact for employers were better able to address their workforce needs.

Align STEM programs to workforce demands locally, regionally, and on a larger scale.

- Partner with industry to regularly assess in-demand jobs as the market changes.
- Invite business and industry representatives to share "soft skills" and other non-technical skills required to be an effective employee
- Partner with business and industry to identify any relevant short-term credentials

Include employers to actively participate in STEM programs

- Invite business and industry partners to provide programmatic oversight and leadership through joining an advisory council
- Invite business and industry partners to advise and inform program design to ensure alignment with hiring pain points and industry standards
- Invite business and industry partners to partner in program delivery through models such as earn and learn, internships, and co-ops
- Invite business and industry partners to offer students placement support such as mock-interviews, informational interviews, networking opportunities, and/or direct job placement
- Explore options for employers to potentially provide financial support to the program including:
  - Funding for equipment
  - Stipends for students
  - Offset for technical staff salaries
- Explore options for employers to potentially provide in-kind support to the program including:
  - Speakers
  - Loaned technical staff for instruction
  - Donated equipment
  - Donated lab space

Connect with K-12 Educators to enrich learning and create strong STEM guided pathways.

- Working with local school districts to offer college credit courses through dual-credit and College Credit Plus
- Conducting outreach opportunities such as visits to your school or supporting clubs and other informal learning experiences
- Providing pre-service STEM-focused teachers with placements for student teaching
- Sharing lab spaces and STEM resources with local school districts for programming
- Partnering to develop aligned and innovative STEM curricula.

Self-Assessment:

Do you effectively engage employers?

- Active advisory committees that facilitate discussion to identify industry needs, standards, and future trends
- Employers provide input on STEM program design and curricula
- Active partnerships with employers to provide students with work-based learning and earn and learn programs
- Employers are meaningfully contributing to program through in-kind donations or sponsorship
- Local employers are actively recruiting and hiring students from your STEM programs

Are you taking advantage of programs to support STEM programs from the State?

- Ohio Department of Higher Education's Choose Ohio First Program

https://www.ohiohighered.org/cof

- Ohio Department of Higher Education's GEAR UP Program

https://www.ohiohighered.org/gearup

- Ohio Tech Net Program

https://ohiotechnet.org/education-partners/

- RAPIDS Program

https://www.apprenticeship.gov/help/what-rapids

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Story from the field

Through a consortium of higher education institutions, Sinclair College is working to address the need for a more highly skilled workforce; one that is adaptive, technical, and that has automation-era skillsets. The FlexFactor program, by NextFlex, is the collaborative technology and entrepreneurship program, funded by the Department of Defense, that allows youth to discover the value of a career in advanced manufacturing. The 5-8 week program immerses high school students in the world of advanced manufacturing and encourages them to consider a career in STEM! This academic year, 67 teams of high school students: identified a world problem; conceptualized a product to address the problem; built a business model; then pitched their product ideas to a panel of academic and industry professionals

GUIDANCE FOR BUSINESS AND INDUSTRY

Employers often grapple with skill gaps in STEM that can hinder their businesses. Effective solutions to this challenge emerge when employers contribute essential knowledge and resources to improve education and training programs. As such, identifying and implementing innovative roles for employers to connect with the web of educational institutions, training providers, and public workforce systems is critical.

Build partnerships- Develop working relationships with community, education, and other business partners. This includes:

- Identify internal collaborators who can inform or participate in business advisory councils and other partnerships focused on improving STEM and technical learning
- Identify how your company can actively foster new and current relationships with partners
- Identify opportunities, such as instructor externships, that help build educator awareness of the realities of working within your industry and organization

Identify professional STEM skills needed for future careers- Work with your local education partners to delineate key professional skills that will be needed for the future job market and advise curriculum that instills these skills. This includes:

- Identify shared goals with educators for how professional skills will be taught- including through aligned work-based learning experiences
- Make recommendations for how to strengthen business advisory council plans to meet pressing workforce needs
- Identify industry-recognized credentials currently being used within your company

Support Program Delivery- Work with education and community partners to coordinate experiences that allow students to build and demonstrate proficiency in critical STEM skills that will aid in future employment opportunities. This includes:

- Offer work-based learning opportunities for students
- Provide feedback on student progress in experiential learning opportunities, including which are earning industry-recognized certifications and and experiences that contribute to the OhioMeansJobs Readiness Seal
- Provide financial and/or in-kind resources to support the sustainability of quality programming
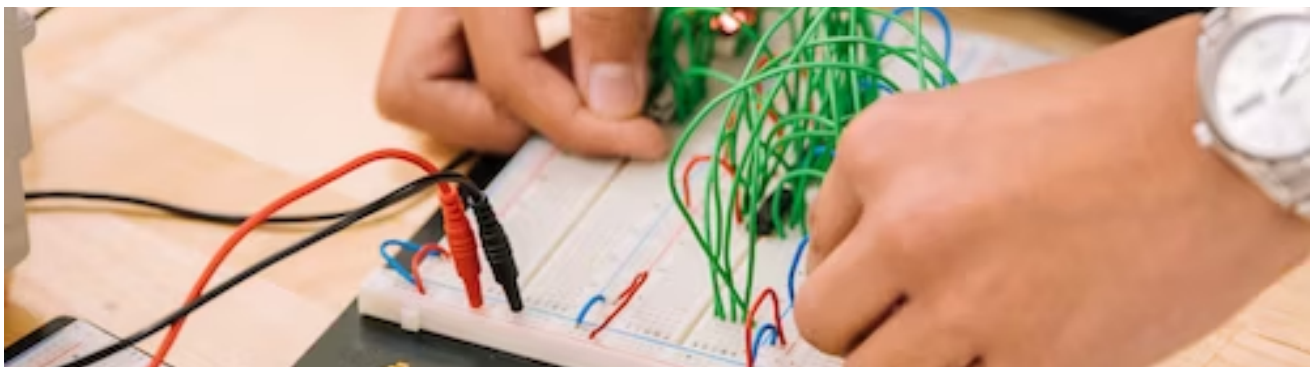
Self-Assessment:

Are you involved in your local education community?
- Serving in a leadership capacity on governance structures for schools or STEM networks
- Participating in Business Advisory Councils
- Partnering with Career-technical Education providers
- Ensuring instructors are aware of industry trends and standards
- Providing instructors with externships and professional workshops
- Providing career information and resources to students and families
- Providing career-exploration and work-based learning opportunities for students
- Providing financial or in-kind support to pilot and sustain work-based learning and experiential STEM learning

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- **Summer jobs-** Summer jobs are paid opportunities that allow students to experience the workplace environment, demonstrate key professional skills such as reliability, work ethic, punctuality, teamwork and discipline during their summer break.

Story from the field

Rockwell Automation is a global technology leader focused on helping the world's manufacturers be more productive, sustainable, and agile. Rockwell Automation employs approximately 26,000 people and has customers in more than 100 countries worldwide. Rockwell offers an 8 – 10 week internship journey through the world of industrial automation at their Mayfield Heights campus near Cleveland, OH. Open to high school junior/seniors or an enrolled college freshman- the experience offers students hands-on learning in a team environment. Interns gain exposure to the industrial automation industry and opportunities in areas such as: hardware design; cybersecurity; embedded software development/testing; and web development. Over the summer, interns will learn about and use Rockwell products, contribute to a hands-on engineering development team project, network with experienced engineers and technical leaders, and receive personalized career/professional coaching and mentorship.

EQUITY CONSIDERATIONS

A National Academies of Science, Engineering, and Medicine (NASEM) study on educational equity found that learning opportunities and enrollment patterns in STEM affect long-term learning trajectories and post-secondary education major choices. Disparities in educational attainment among population groups have long been present in the United States. Students from families that are white, have relatively high incomes, and are proficient in English have tended to have higher rates of educational attainment than other students. An education system that benefits certain groups over others misses out on the talent of the full population of students, resulting in a loss both for the excluded students and for society. Recognizing the importance of ensuring all students are represented and have a sense of belonging in STEM this section reviews considerations for how to embed equity into STEM programming based on best and emerging practices. The National Science Foundation has identified effective strategies and practices to broaden STEM participation from their INCLUDES program:

Developing Culturally Responsive Pedagogical Practices: The practice of infusing cultural knowledge and real-life experiences into teaching and learning. Key actions include:
- Providing professional development for faculty on how to plan and implement culturally responsive pedagogy in key subjects such as mathematics.
- Connect classroom teaching to context-specific scenarios
- Contextualize STEM learning from an early age to develop student interest in STEM topics
- Integrating in-school mentoring with out-of-school STEM activities
- Provide out-of-school activities which incorporate historical viewpoints with students' cultural knowledge and lived experiences
- Provide connection to STEM Role Models who are reflective of underrepresented communities to build sense of belonging
- Support programs which reduce barriers to out-of-school time programs and activities including transportation support, accessibility modifications, and scholarships/reduced tuition

Provide Family Support: Engaging family members to encourage and support students to enter and stay in STEM educational experiences. Key actions include:
- Encouraging students to discuss STEM topics with family and friends to foster community interest and honor family knowledge
- Expose families to local STEM experiences and industry through inviting participation in activities, events, opportunities and programs
- Support community-driven initiatives which help families understand the college-going process, including how to access financial aid
- Support initiatives which help families address barriers to student participation in STEM including accessibility support, childcare assistance, and transportation assistance

Provide opportunities for hands-on learning: Experiential learning which encourages students to participate in STEM fields through engaging activities. Key actions include:

- Provide opportunities for STEM field trips (museums, gardens, parks, etc.) and for job-site visits to STEM industries
- Provide opportunities for students to simulate hands-on tasks which are critical to STEM industries (working with tools, simulating design on computers, etc.)
- Work with STEM companies to develop real-life scenarios for integrated curriculum
- Ensure all hands-on activities can be performed by students with visible and invisible disabilities

Summer Bridge Programs: Academic programs that focus on including underrepresented groups for participation, with the aim to increase STEM education and workforce recruitment. Key actions include:

- Offer summer programs that expose students to information about STEM degrees and careers
- Provide opportunities to connect with alumni, advisors and faculty- with a focus on representation and inclusivity
- Provide opportunities for students to develop cohorts and networks of support with other students from similar backgrounds
- Support programs which reduce barriers to summer bridge programs and activities including transportation support, accessibility modifications, and scholarships/reduced tuition.

Research Experiences: Student immersion in meaningful research experiences. Key actions include:

- Offer paid experiences to conduct embedded research in STEM fields and topics
- Support students to co-create and participate in research that draws from their own experiences and individual ideas
- Identify unique and innovative research projects which incorporate cultural background
- Work with local STEM companies and organizations to identify research opportunities for students

Counterspaces: Supportive environments that provide safe and inclusive experiences that promote belonging. Key actions include:

- Create cohorts of students from a similar background to conduct STEM learning and related activities
- Create experiences that expose students to STEM research conditions that affirm their identities and backgrounds
- Create opportunities for students to participate in STEM diversity conferences
- Develop or support STEM student-affinity groups

Mentoring: The process by which mentors advise, and establish long-term relationships that benefit a mentee's educational and career development. Key actions include:

- Develop mentorships opportunities in which the mentor has a similar background to the mentee
- Develop mentorships programs with access to multiple mentors, a mix of mentoring approaches, supportive and encouraging mentors, and having a shared understanding (mentor-mentee) of the mentoring relationship
- Encourage local STEM employers to participate in mentorship programs