2023

UNITING STEM EDUCATION AND WORKFORCE

TIES™
Uniting Partners. Transforming Learning.

THE NewGrowth GROUP

The Office of Science and Technology Policy (OSTP) describes science, technology, engineering, and mathematics (STEM) as the foundation for discovery and technological innovation. OSTP goes on to note that "STEM skills are increasingly important for all Americans to succeed in the workplace and in their everyday lives. To develop these skills, the Nation must engage in a collaborative effort to ensure that all Americans have access to high-quality STEM education throughout their lifetimes. A focus on diversity and inclusion in STEM requires attention to opportunities across education and career pathways. This effort is especially important for those who are historically underrepresented and underserved in STEM. A well-prepared and diverse STEM workforce is essential to maintaining global leadership as it galvanizes the ingenuity of Americans to accelerate tomorrow's breakthroughs and strengthens our economic and national security."

Recognizing the national importance of STEM education, the National Science Foundation has set for the following vision statement for the STEM Education of the Future ""All citizens can contribute to our nation's progress and vibrancy. To be prepared for the STEM careers of the future, all learners must have an equitable opportunity to acquire foundational STEM knowledge. The STEM Education of the Future brings together our advanced understanding of how people learn with modern technology to create more personalized learning experiences, to inspire learning, and to foster creativity from an early age. It will unleash and harness the curiosity of young people and adult learners across the United States, cultivating a culture of innovation and inquiry, and ensuring our nation remains the global leader in science and technology discovery and competitiveness."

STEM jobs and career opportunities are growing at an exceptional rate. The National Science and Engineering Indicators estimate that there are over 36 million people working in occupations that require STEM knowledge and expertise. STEM jobs have grown faster than non-STEM jobs for over a decade and this trend is expected to continue. . With this in mind, it is critical that business leaders take an active role in engaging our student population to ensure a sustainable pipeline of STEM-trained future employees.

The integration of STEM Education and Workforce Development is critical to meet the demands of the future. This integration 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.

Purpose of This Document

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 (STEM Networks, Local School Districts, Institutions of Higher Education, and Business and Industry) 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.. The last section provides an overview of how STEM Learning Ecosystems can embed equity into their practices and actions.

Guidance for STEM Learning Ecosystems

How To:

At the systemic level, STEM Learning Ecosystems are uniquely positioned to bring together multiple stakeholders to help the integration of workforce and education. Through dedicated research 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

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

- 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.

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

- 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.

3. 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
- Aligning activities with industry needs
- Engaging industry and employers in STEM activities and efforts
- Participating in program 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?

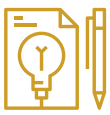
- STEM summer camps- STEM summer camps are out-of-school time programs that provide students the opportunity to engage in depth in STEM content and aligned activities.

- **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

- **STEM classroom and virtual speakers-** Classroom speakers are volunteers who share their stories about their STEM career pathways and provide information about their industry or occupation

- **STEM career-focused competitions-** Career competitions expose students to STEMcareer pathways and engage them in a rich learning environment where they can explore their interests and passions.



- **Client-focused projects-** In client-focused projects, an employer creates an authentic "problem" or task for the learners to solve or complete. This 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

- **Informational interviews-** An Informational Interview is an informal conversation between a volunteer and a student where the scholar asks questions to the volunteer about their occupation and industry.

- **Company site tours-** On site tours, students are hosted by a company for a tour of the work-site. Each tour should include an introduction to the business/organization, key career pathways or specific in-demand careers within the organization, and why this line of work is important.

- **Coaching-** Coaching engagements connect a volunteer with students in a short-term structured session(s) to accomplish a specific career or professional development learning objective.

- **Mentorship-** Mentorship engagements connect a volunteer with students in a long-term informal or formal relationship where they advise on topics related to career pathways and professional development which may include career options, personal branding, relationship building, exploration of strengths and interests, and decision making.

- **Apprenticeship-** An apprenticeship is a combination of on-the job training and related technical instruction. A student must be at least 16 years of age where a higher minimum age standard is required by law. An apprenticeship program must be registered with The Ohio Apprenticeship Council to teach a skilled occupation pursuant to a registered apprenticeship agreement.

- **Internships-** An internship is a form of experiential learning that integrates knowledge and theory learned in the classroom with practical application and skills development in a professional setting. Internships give students the opportunity to gain valuable applied experience through meaningful work and make connections in professional fields they are considering for career paths; and give employers the opportunity to guide and evaluate talent. The student performs tasks and demonstrates skills necessary for the operation of the business or organization, as determined by the employer with additional guidance from the instructor or educational supervisor.

- **Job placements-** In a job placement, an employer commits to creating job opportunities for students or connecting students with open job opportunities.

- **Job shadowing-** A job shadow is an experience that takes place on the work-site where students observe a professional in their workplace setting to gain a better understanding of the career pathway, skills and competencies to succeed in that role.

- **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

NeoSTEM creates and cultivates STEM education opportunities in the northeast Ohio communities that need - and crave them - the most. NeoSTEM functions as an ecosystem, a collaboration of individuals and organizations from education, business and industry, government, out-of-school-time partners, a wide array of cultural institutions, philanthropy and others - all acting with shared beliefs and working toward a common goal. That goal is to introduce all students to the power and opportunity that comes with STEM, and to support them along their educational and career pathways.

NeoSTEM believes:

- We believe in the power of STEM-driven education and thinking. We recognize that in a world dominated by technology and connectivity, a command of STEM concepts is essential. Every profession, every job, now requires STEM thinking.
- We believe STEM is a force for social mobility, one that elevates individuals, families, and entire communities, and positions them to achieve their potential.
- We believe in the power of diversity as a change agent. Northeast Ohio will continue to evolve and prosper as a community if all of its residents are ensured equality of opportunity in education.
- We believe that far too many among us - particularly those counted as Black, Brown, or poor - are without even basic educational resources that others take for granted. We understand that a lack of diversity in northeast Ohio's workforce represents a denial of talent to our region.

NeoSTEM serves its mission by creating and coordinating ongoing STEM programming for students and families of all ages, and by hosting signature events that showcase the world of STEM thinking and opportunity. The section below describe initiatives lead by NeoSTEM.

WIR'ED is a program that pairs tech-savvy, "digital native" high school students with small business owners and non-profit operators to expand the organizations' online footprints and improve their digital operations. With the guidance of NeoSTEM staff and assistance from volunteer creative professionals, students and businesses work together to build and refine business websites, create social media content, and develop marketing materials.

WIR'ED Success Story

Sherolynn Eppinger, owner of 1000 lbs. Lighter Fitness on 131st Street in Cleveland, understands the symbiosis between students and businesses participating in WIR'ED.

"My student was very knowledgeable, and had great ideas that matched perfectly with my ideas and vision. She made major updates to my website, along with promotions and marketing. As a small business owner doing all the work, it was a big help having the extra hands and ideas. It also allowed her to see how the work comes together and is used for business. So the experience on both ends is beneficial and more students should have this experience."

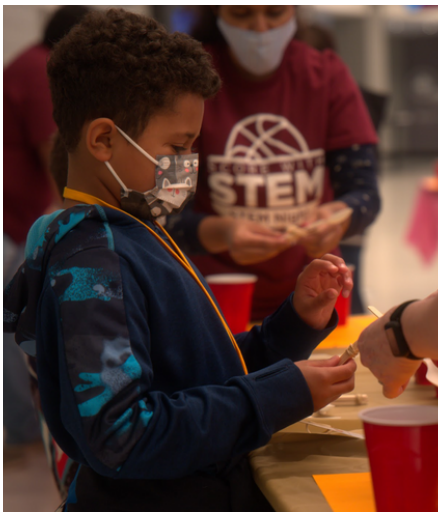
Be sure to visit 1000 lbs. Lighter Fitness' website.

"I Am STEM" is an outreach campaign to elevate the visibility of BIPOC STEM professionals in northeast Ohio. In the program, NeoSTEM interviews people in STEM professions to discuss their upbringing, education, and career paths. From these interviews, NeoSTEM produces videos and printed materials profiling the individuals, and makes those materials available for public distribution. The posters are displayed in every CMSD school building and student's can access the recorded videos through PACE, a Planning and Career Exploration program.

STEM in My Neighborhood is an umbrella initiative to foster STEM programming at the neighborhood level in unique communities throughout the Cleveland metropolitan area. Through the initiative, NeoSTEM offers "STEM stipends," which function as "micro grants" to individuals and community organizations to help enhance existing STEM learning through existing programming.

NeoSTEM's **teacher externship program** places area educators with businesses in STEM-focused industries for hands-on, real-world STEM experiences. Through the program, teachers gain a deeper understanding of the many career pathways available through businesses, and design learning experiences for their students back to their classrooms. Educators become an extension of your HR department's marketing team.

Score with STEM is a signature event designed to spark excitement and interest through sports, and reveal the many behind-the-scenes career opportunities available through STEM. In partnership with the Cleveland Cavaliers, NeoSTEM hosted more than 50 hands-on STEM exhibits and welcomed more than 1,500 students and families to the Rocket Mortgage FieldHouse for the event, and provided Cavs game tickets to every attendee.



STEM Exploration is a signature event bringing hands-on STEM exhibits and programming to neighborhood recreation centers in the City of Cleveland. Conducted in partnership with the Office of Prevention, Intervention, and Opportunity for Youth and Young Adults, the pilot event featured afternoons of STEM programming at two recreation centers and welcomed 270 attendees. This program removes barriers to access by bringing STEM into local neighborhoods.

Guidance for Local School Districts

How To:

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 exp

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

- Support Career-Technical Education alignment through engaging Business Advisory Councils
- Establish career-aligned curriculum and resources through inviting business partners to review course materials and share career pathway information
- 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 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.

2. **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

3. 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 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?

- 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/STEAM-related competitions, on-site/online STEM/STEAM exhibits, and/or in local, state and national STEM/STEAM 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/STEAM-focused community learning experiences, relevant to both students and to the community.
- Students and teachers partner with community members to enhance learning experiences.

Does your school offer 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

- **STEM classroom and virtual speakers-** Classroom speakers are volunteers who share their stories about their STEM career pathways and provide information about their industry or occupation

- **STEM career-focused competitions-** Career competitions expose students to STEMcareer pathways and engage them in a rich learning environment where they can explore their interests and passions.

- **Client-focused projects-** In client-focused projects, an employer creates an authentic "problem" or task for the learners to solve or complete. This 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

- **Informational interviews-** An Informational Interview is an informal conversation between a volunteer and a student where the scholar asks questions to the volunteer about their occupation and industry.

- **Company site tours-** On site tours, students are hosted by a company for a tour of the work-site. Each tour should include an introduction to the business/organization, key career pathways or specific in-demand careers within the organization, and why this line of work is important.

- **Coaching-** Coaching engagements connect a volunteer with students in a short-term structured session(s) to accomplish a specific career or professional development learning objective.

- **Mentorship-** Mentorship engagements connect a volunteer with students in a long-term informal or formal relationship where they advise on topics related to career pathways and professional development which may include career options, personal branding, relationship building, exploration of strengths and interests, and decision making.

- **Apprenticeship-** An apprenticeship is a combination of on-the job training and related technical instruction. A student must be at least 16 years of age where a higher minimum age standard is required by law. An apprenticeship program must be registered with The Ohio Apprenticeship Council to teach a skilled occupation pursuant to a registered apprenticeship agreement.

- **Internships-** An internship is a form of experiential learning that integrates knowledge and theory learned in the classroom with practical application and skills development in a professional setting. Internships give students the opportunity to gain valuable applied experience through meaningful work and make connections in professional fields they are considering for career paths; and give employers the opportunity to guide and evaluate talent. The student performs tasks and demonstrates skills necessary for the operation of the business or organization, as determined by the employer with additional guidance from the instructor or educational supervisor.

- **Job placements-** In a job placement, an employer commits to creating job opportunities for students or connecting students with open job opportunities.

- **Job shadowing-** A job shadow is an experience that takes place on the work-site where students observe a professional in their workplace setting to gain a better understanding of the career pathway, skills and competencies to succeed in that role.

- **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 DoD STEM Ambassador Program recognizes outstanding educators and promotes STEM learning across the nation. DoD STEM Ambassadors work together to create and curate remote learning and digital materials such as lesson plans, learning activities, and creative engagement approaches to be shared with educators. STEM Ambassador- Toni Kaui shared the following story about integration of STEM and workforce in a blog post:

Nā Hunaahi, an independent high school in East Hawai'i, teaches students 'ōlelo Hawai'i, native Hawaiian language, and mo'omeheu, native Hawaiian cultural practices, via design-based integrative STEAM curricula and community partnerships. Recently, Nā Hunaahi students worked with Hui Ho'oleimaluō, a community organization committed to restoring and revitalizing coastal fishponds to design a board game to engage students in its mission.

Nā Hunaahi students spend one hour each day working with and learning from community elders, also known as "aunties" and "uncles," to gain knowledge, skills and experiences necessary to become kia'i, or protectors and caretakers of the fishpond. In addition to their daily studies, students participate in a year-long project that addresses a specific need of Hui Ho'oleimaluō.

Hui Ho'oleimaluō leaders expressed their passion and commitment to teach all students about the fishpond, not just those who lived close enough to visit. This wish became the foundation of a year-long design challenge for a small group of students.

The curriculum design involved multiple moving parts which were pursued simultaneously and sometimes individually. First, students needed to identify a strategy to raise awareness of the fishpond beyond its physical borders. Once a strategy was determined, students could focus on how to bring it to life. The first challenge for the group was identifying different strategies educators had used to teach students who were bound to a classroom.

"We had a lot of visits from guests," recalled student Kamakoa. "I remember we played that game with the 'Ohi'a lady where we held up signs. Aunty Lahela guys also brought that watershed game we played. But my favorite has to be the spin-the-wheel game we played with Aunty Nicole and Uncle Bronson guys!"

Students shared memories of other classroom visitors and how their stories and activities helped students learn. They thought playing educational board games with these visitors was the most satisfying and engaging activity that they had experienced.

After deciding to create, design and manufacture a board game, students branched out into multiple pathways. Based on self-identified areas of study, they individually learned science, math and social studies content that satisfied the knowledge they would need for game development as well as being able to demonstrate proficiency and/or mastery of competency content. Content areas included climate change, hydrology, marine plant and animal biology, ecology, economics and governance. While simultaneously learning academic content, students collected on-site data to incorporate real-world statistics from the fishpond itself, including water quality, water flow, fish count, and number of daily visitors.

As students collected data and mastered content knowledge, they also conducted research on different types of board games. They played more than 20 board games and identified elements that they believed would maximize engagement and fun for K–12 students. "Learning how to play all of those different board games was my favorite part of this project," exclaimed student Gabriel. The team also decided to include multiple skill levels to make it more challenging for higher grade levels. They created four skill levels — one each for grade bands K–2, 3–5, 6–8 and 9–12 — and increased difficulty by incorporating higher levels of science and moral decision-making.

The finished game is currently in production with a professional game manufacturer. Students hope to gift the game to Hui Hoʻoleimaluō during an upcoming graduation ceremony. A sophomore student is in the process of digitizing the game as a phone app. The final aspect of this project included forming a for-profit business with the hope that future students develop games for other cultural practitioners as a way to raise money for school operations.

Toni Kaui. (2022, March 17). "We Designed a Game!" Meet DoD STEM: https://dodstem.us/meet/blog/entries/we-designed-a-game/

Guidance for Institutions of Higher Education

How To:

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.

1. **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

2. **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

Guidance for Institutions of Higher Education

How To:

- 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

3. 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

- National Science Foundation: https://www.nsf.gov/funding/programs.jsp?org=EDU
- U.S. Department of Energy: https://www.energy.gov/doe-stem/doe-stem
- U.S. Department of Education: https://www.ed.gov/stem
- U.S. Department of Defense: https://dodstem.us/

Story From the Field

East Mississippi Community 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, 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! In its first 6 months of implementation, almost 400 students completed the program. Nationwide, FlexFactor has reached over 10,000 students. Of these students 81% of students share that they are more aware of the career opportunities available to them in STEM and advanced manufacturing after participating in FlexFactor. 82% of students are more aware of the educational resources and pathways available to help make their dreams a reality.

Guidance for Business and Industry

How To:

Employers often grapple with skill gaps in S.T.E.M. 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.

1. **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 S.T.E.M. 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

2. Identify professional S.T.E.M. 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
3. Support Program Delivery- Work with education and community partners to coordinate experiences that allow students to build and demonstrate proficiency in critical S.T.E.M. 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 graduation requirements.
   - 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 S.T.E.M. learning

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

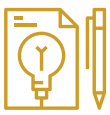
- STEM summer camps- STEM summer camps are out-of-school time programs that provide students the opportunity to engage in depth in STEM content and aligned activities.

- **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

- **STEM classroom and virtual speakers-** Classroom speakers are volunteers who share their stories about their STEM career pathways and provide information about their industry or occupation

- **STEM career-focused competitions-** Career competitions expose students to STEMcareer pathways and engage them in a rich learning environment where they can explore their interests and passions.



- **Client-focused projects-** In client-focused projects, an employer creates an authentic "problem" or task for the learners to solve or complete. This 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

- **Informational interviews-** An Informational Interview is an informal conversation between a volunteer and a student where the scholar asks questions to the volunteer about their occupation and industry.

- **Company site tours-** On site tours, students are hosted by a company for a tour of the work-site. Each tour should include an introduction to the business/organization, key career pathways or specific in-demand careers within the organization, and why this line of work is important.

- **Coaching-** Coaching engagements connect a volunteer with students in a short-term structured session(s) to accomplish a specific career or professional development learning objective.

- **Mentorship-** Mentorship engagements connect a volunteer with students in a long-term informal or formal relationship where they advise on topics related to career pathways and professional development which may include career options, personal branding, relationship building, exploration of strengths and interests, and decision making.

- **Apprenticeship-** An apprenticeship is a combination of on-the job training and related technical instruction. A student must be at least 16 years of age where a higher minimum age standard is required by law. An apprenticeship program must be registered with The Ohio Apprenticeship Council to teach a skilled occupation pursuant to a registered apprenticeship agreement.

- **Internships-** An internship is a form of experiential learning that integrates knowledge and theory learned in the classroom with practical application and skills development in a professional setting. Internships give students the opportunity to gain valuable applied experience through meaningful work and make connections in professional fields they are considering for career paths; and give employers the opportunity to guide and evaluate talent. The student performs tasks and demonstrates skills necessary for the operation of the business or organization, as determined by the employer with additional guidance from the instructor or educational supervisor.

- **Job placements-** In a job placement, an employer commits to creating job opportunities for students or connecting students with open job opportunities.

- **Job shadowing-** A job shadow is an experience that takes place on the work-site where students observe a professional in their workplace setting to gain a better understanding of the career pathway, skills and competencies to succeed in that role.

- **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.

Numerous national companies offer important aligned opportunities for learners of all ages. These organizations have been engaged in intentional outreach to share the opportunities with learners in formal and informal learning settings.

The following are a few examples of the free opportunities that are available to learners:

- Siemens has developed Hour of Engineering, a free and engaging online program to empower educators to introduce students to engineering technology with right-sized, kid-friendly learning content in as little as one hour.
- IBM, with its SkillsBuild initiative, is working to skill today's learners to meet challenges and opportunities of tomorrow. IBM SkillsBuild is a free program of online courses that allow learners of all ages to gain valuable skills, earn verified digital credentials, connect with mentors and explore fields and careers ranging from Artificial Intelligence to Cybersecurity. This particular opportunity is to work with SkillsBuild for high school students.
- Amazon, with its AWS Skill Builder, offers online learning courses intended to support learners with cloud computing skills. With challenges and open-ended problems, AWS Skill Builder is also designed to support students develop problem-solving skills. Courses are designed to be engaging and are customized to the needs of particular industries.

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