

Educator Corporate Partnership for STEM Learning (ECP)

Project Approach and Management

According to the *National Science Board Science and Engineering Indicators 2018*, the number of jobs in the United States requiring substantial science, technology, engineering, and mathematics (STEM) expertise has grown nearly 34% over the past decade. Just as compelling, "Your school system today is your economy of tomorrow." *Andreas Schleicher, Director of Education and Skills at the Organization for Economic Cooperation and Development (OECD), 2016.*

Statement of Purpose

To address these systemic challenges, the Allegheny Intermediate Unit Math & Science Collaborative (AIU MSC), in partnership with Partner4Work and Westmoreland/Fayette Workforce Development Board (WDB), will lead an educator/corporate partnership- *Educators Corporations Partnership for STEM Learning (ECP)*. ECP is an innovative consortium approach for teams of K-12 educators to learn, through a six-day experience, what it means to prepare students for a global, knowledge-based, 21st century economy. This program will emphasize career readiness for students. It aims to build sustainable partnerships among 40 educators, representing five school districts, and five local STEM corporations/businesses.

Participating school districts in Allegheny County include Penn Hills, Avonworth, Pine-Richland, and Brentwood. The fifth District, Greensburg Salem, serves students who reside in Westmoreland County. Ultimately this project has the long-term potential to impact more than 17,000 students, K-12, with approximately 30% of these students qualifying for free or reduced lunch cost. The corporations, PPG (three corporate sites), Arconic, Aethon, and the Eaton Corporation, will provide direct support for the participating school districts through hosting on-site facility tours, which include involving educators in authentic job-embedded experiences. Additionally, corporations will consult with school district teams on enhancing their STEM curriculums to better reflect the realities of the modern STEM workplace.

The core activities of the ECP program will provide educators with first-hand experiences in corporations and businesses that allow them to gain a better understanding of the STEM work environments. They will apply this understanding to better prepare students for college and career, with a particular emphasis on integrating Career Education and Work Standards (CEW) into the existing curriculum. Through participation in this project, STEM professionals in corporations and businesses will gain a better understanding of STEM education at the K-12 level so they are better able to support school districts in preparing students for the STEM workplace. ECP presents an opportunity for K-12 educators and STEM professionals to work together to develop a curriculum that connects to the world beyond the classroom and provides students with experiences that are more directly transferable to career contexts.

Career Pathway(s) Focus

According to the *Workforce Innovation & Opportunity Act: Multi-Year Regional Plan: Program Years 2017-2019*, manufacturing was identified as a high priority occupation in Southwestern PA. Each of the partner corporations in this program is a world renowned manufacturer in its own right, specializing in creating mid-stream or end-of-line products using innovative metals, alloys, coatings, or processes. Additionally, the *Ecosystem Assessment for Additive Manufacturing in the Greater Pittsburgh Metals and Materials Community (GPMMC), 2016* indicated that "a strong Additive Manufacturing (AM) cluster is rapidly emerging in the greater Pittsburgh region consisting of Southwestern Pennsylvania and northern West Virginia. As the University of Pittsburgh (Pitt) and Carnegie Mellon University (CMU) conduct extensive research

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into AM materials and processes, well-known manufacturers such as Alcoa (now Arconic), Allegheny Technologies, GE, Kennametal and Westinghouse Nuclear are embracing the technology and investing in advanced manufacturing facilities incorporating AM.” As a result of the program, educators will gain first-hand experience about the skills, knowledge-base, and habits of mind necessary for workers to be successful in these high-priority occupations.

Program Goals

1. Forty educators will recognize the important role that the practice standards featured in the Common Core State Standards for Mathematics (CCSSM) and the Next Generation Science Standards (NGSS), International Standards for Technology Education (ISTE), and Career Education and Work Standards (CEW) play in student learning experiences, and they will develop plans to integrate them into their classrooms.
2. STEM professionals in five corporations and businesses will deepen their understanding of the essential educational shifts underway in the K-12 system.
3. Five school districts and five local corporations will build sustainable partnerships.

Learning Outcomes

ECP will accomplish this through the following objectives and outcomes:

	Objectives/Outcomes	Measureable Results
1	K-12 Educators deepen their understanding of how the mathematics and science and engineering practices featured in the Common Core State Standards (CCSS), the Next Generation Science Standards (NGSS), and the International Standards for Technology Education (ISTE) are utilized in the workplace.	<ul style="list-style-type: none"> • At the end of their corporate visits, educators will engage in a debrief process, during which each educator will share six pieces of evidence for the practice standards observed in the workplace. • Educators will respond to survey questions. • In their final presentation, educators will show how the CCSS and NGSS practice standards will be addressed in learning opportunities for students.
2	K-12 educators will better understand the Career Education and Work Standards (CEW) and the requirements of the modern STEM workforce.	In their final presentation, educators will identify three ways in which they will integrate CEW standards into their curriculum/programs to ensure that all students experience meaningful engagement in career exploration and preparation.
3	Educators will plan to adapt their curriculum based on their deepened understanding of workforce demands.	In their final presentation, educators will identify one authentic problem-based learning opportunity for students that they planned or adapted as a team during the

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		ECP experience. (This can be a new course, a new unit, or systemic changes in teaching and learning.)
4	Each school district and the corporation/business its teachers visited will form a sustainable partnership.	<p>In their final presentation, school districts will:</p> <ul style="list-style-type: none"> • Describe at least one joint event of the corporation and school district in the 2019-2010 school-year to which the district and corporation/business have committed. • Identify a plan that continues/extends that partnership over the next five years.

Schedule of Activities

Each school district will identify a team of K-12 educators, who will participate in a six-day experience (42 hours) to enhance their capacity in STEM workforce education. Act 48 hours will be awarded. **The team, comprised of eight educators, can include teachers of mathematics, science, technology, and English Language Arts, as well as librarians, special education teachers, and should include a guidance counselor and an administrator.** Including a high school student in some or all of the experience is optional. Over the course of six days, teams of K-12 educators will work to enhance their curriculums by partnering with a corporation to address the ***guiding question “How might we strengthen our STEM curriculum so that all students experience authentic real world problem solving and acquire the essential skills and knowledge required to be career ready and successful in a 21st century STEM corporation/business?”*** The openness of this problem statement invites a multitude of possible solutions. To ensure a true partnership between school districts and corporations/businesses, both sides need to have a clear purpose for participating. AIU MSC will conduct an orientation with all corporate/business partners to highlight important aspects of the CEW standards and ISTE, the standards of practice from NGSS and CCSSM, and how the federal education law, Every Student Succeeds Act (ESSA), addresses STEM education. Additionally, time will be spent discussing possible ways for corporations to collaborate with districts to inform curriculum, share resources available through local workforce boards, and discuss possible strategies for making hiring practices friendlier to youth. Corporations/businesses will decide how to share this information internally to prepare for the site visits.

Workplace Immersion

A transformative experience in this program is an entire day spent immersed in the workplace environment of a corporate partner, observing the significant role that practice standards from the NGSS and CCSSM and ISTE standards play in businesses. Equipped with this evidence, district teams reflect on and plan to infuse these critical practices into classroom experiences. Day 4 of the program enables district teams to build on and refine their plan of action through interviewing stakeholders in their districts (teacher colleagues, administrators, support personal, families, and community members) and meeting with their corporate partner. This meeting can occur virtually or face to face at the corporation or within the school district. Teams will share the results of their constituent interviews and their initial action plan with their corporate partner who will provide constructive feedback for improvement to the plan.

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Customized Professional Learning

As laid out in figure 1, wrapped around the immersive corporate experience will be three days of customized professional learning and facilitated action planning led by STEM education experts from the AIU Math & Science Collaborative. Unpacking the CEW, CCCSM and NGSS practice standards and ISTE standards, and relying on the work of Anne Jolly, *STEM by Design*, 2016 and *The Case for STEM Education, Challenges and Opportunities*, by Roger Bybee, district teams will explore research-supported attributes of STEM literacy that align with modern STEM workforce competencies. Additionally, educators will experience inquiry-based learning and engineering design activities, and affirm the critical components of an effective learning environment that supports STEM learning for all students. **Time for teams to apply what they learned from their corporate experiences and the wrap-around PD is built into each of the four days.** The final day of the program (Day 6 symposium) will feature each district team presenting their action plan to address their problem before a panel of corporate partners and the other district teams. The partnership between the school district and the local corporation, which starts with the school district visit to the corporation, will be built over the course of the program through virtual meetings or a school visit by the corporate partner (Day 4) , and the final presentation (Day 6 symposium). This partnership will be sustained beyond the duration of the current year, with the district and corporate partner committing to one special event during the 2019-20 school year, as well as a plan for future years, both of which will be presented at the Day 6 symposium.

As stated in the introduction to the PDE Career Education and Work Standards, "It is the rapidly changing workplace and the demand for continuous learning and innovation on the part of the workers that drive the need to establish academic standards in Career Education and Work." (2006). The continuous learning and innovation aspect of this statement is the common thread that runs through all aspects of the ECP program. Many of the CEW standards connect to the work of the ECP program, but in particular the standards pertaining to career awareness and preparation will be observable during the on-site corporate/business visits. Educators will be charged to plan for and include these standards in their revised curriculum. For example, standard 13.1.3 F. *Explore how people prepare for careers* will be observed through interviews with the STEM experts at the corporation/business. Teachers will carefully consider how and where to address this standard in their curriculum. As shown in the table below, this program will span a total of six days, 42 hours, combining both on-site learning in the workplace environment of the partner corporations and time for the educators to integrate and connect the workplace skills into their curriculum.

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Day 1 AIU	Day 2 Business	Day 3 AIU	Day 4 District/ Business	Day 5 AIU	Day 6 AIU
Introduction to the Program	Corporate Visit	District STEM Program Assessment	In-District Interviews with colleagues, students, families, community members	Share and discuss preliminary plans	STEM Action and District-Business Partnership Plan Presentation
Labor Market Data and CEW Resources for School Districts					
CEW Standards and Literacies for STEM					
Adult Learner Immersion into STEM		Adult Learner Immersion into STEM	Meeting with Corporate Partner (on-site or virtual)	STEM in the Classroom	
Debrief on Practice Standards and STEM literacies	Debrief on Practice Standards and STEM literacies	Debrief on Engineering Design STEM Resource Overview	Preliminary STEM Action Plan with District-Business Partnership Plan	Preparation for STEM Action and District-Business Partnership Plan Presentation	Next Steps
Reflections with Colleagues	Reflections with Colleagues	Reflections with Colleagues	Reflections with Colleagues	Reflections with Colleagues	Program Evaluation
					Evaluation of the Program

Figure 1. ECP Six Day Overview

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Day 1: An overview of the program and expectations for each district team. Review labor market data and share CEW resources that are available to school districts. Examine the CEW standards and discuss how they currently are being addressed in the districts. Establishing a baseline for the current status of each district's STEM curriculum. Read and discuss various definitions of STEM education, including the work of Roger Bybee, *The Case for STEM Education, Challenges and Opportunities*, and *STEM by Design*, by Anne Jolly. All participants will receive a personal copy of the latter. The focus will be on the importance of the mathematics, science, and engineering practices defined by the CCSSM and NGSS, respectively. Also, three literacies outlined in the *7th Annual U.S. News and World Report STEM Solutions Presents: Workforce of Tomorrow* (2018), 1), namely Tech literacy, 2) Data literacy, 3) Human literacy, will be explored. To develop a deeper understanding of the practices and literacies, educators will engage in an inquiry-based science investigation led by the AIU MSC STEM experts. Teams will begin to consider possible target areas to enhance within their STEM curriculums. Teams will receive instructions for the corporate visit, including expectations for interactions with the STEM professionals, what type of questions to ask to gain insight into information contained in the CEW standards, and how to collect and record evidence of STEM practices and literacies used in the workplace.

Day 2: Each district team will visit its corporate partner on-site where the corporate partner will conduct an orientation and overview of the major work of the corporation. In addition to forming a partnership with the corporation, the main focus of this visit is for educators to experience a work-based performance task and collect evidence around the standards of practice featured in the CCSSM and NGSS. Educators will have the opportunity to interview corporate partners regarding their career. A critical component of this day will be the final debrief led by AIU MSC, for which educators write about and share the evidence collected about the practice standards observed throughout the workplace tour and through their engagement with the work-based performance task.

Day 3: Equipped with data collected from the corporate site visits, educators will assess the current state of their Career Preparation and STEM program. District teams will begin to identify an area within their STEM curriculum that they wish to enhance by answering *"How might we strengthen our STEM curriculum so that all students experience authentic real world problem solving and acquire the essential skills and knowledge required to be career ready and successful in a 21st century STEM corporation/business?"* An important component of this day is for the team to design interview questions and identify a target audience to interview to gain empathy and additional insight around the identified area in the STEM curriculum.

Day 4: District teams will conduct interviews with their targeted audience; colleagues, students, families, community members, etc. A portion of this day will consist of the team connecting with its corporate partner; how and where to meet is flexible and determined by the team and corporation. This meeting time will allow the district team to share interview results and preliminary plans for its plan of action to address its STEM curriculum. Corporate partners are encouraged to provide feedback and support as deemed appropriate.

Day 5: All district teams will convene at the AIU to share and discuss their preliminary plans among themselves and with the other district teams, allowing for further feedback to potentially inform each plan of action. Additional articles and research will be shared with the teams to stimulate additional thought and inform district plans of action. Teams will begin to formalize a final presentation of their plan of action. In addition to addressing the specific measurable results shown in the table above, districts will also be addressing broader questions and incorporate this information into a media presentation to be shared on Day 6:

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1. What did you learn from the Corporate Visits? What are implications for classroom practice?
2. What did you learn from colleague interviews? What are implications for classroom practice?
3. What STEM/STEAM initiative do you already have? How is that influencing your plan for next year?
4. What did you learn from the STEM activities, readings/research at the AIU? How is that influencing your plan for next year? How will you incorporate CEW standards into the curriculum?
5. What is your plan for next year? How will your students' experience next year be different than the one from previous years?

What: What are the changes you are going to make?

Why: Why are you making the changes you are proposing?

How: How do you plan to go about making the changes?

6. What event have you planned with your partner corporation and how will your partnership be sustained?

Day 6: ECP Symposium- Each team will present its plan of action to the other district teams and a panel of corporate partners. Constructive feedback will be provided to each presenting team, creating an opportunity for improvement with each action plan.

Deliverables include district action plans and presentations as well as the evaluation report that will be conducted upon completion of the program. Educators and corporate partners will be included in the evaluation process.

Applicant/Team Capabilities

Lead Agency

Partner4Work is the workforce development board for The City of Pittsburgh and Allegheny County. As the leader of Pittsburgh/Allegheny County's public workforce system, Partner4Work works to ensure that the current and future needs of businesses and job seekers are met. With tens of thousands of jobs available in the Pittsburgh region, Partner4Work bridges the gap between people looking for work and companies in need of talent. Our efforts focus on the development, integration and implementation of a world-class workforce development system in Pittsburgh and Allegheny County.

Partner4Work has more than 20 years of experience serving youth populations, educators, and businesses in our region.

The mission of the AIU MSC is to bring innovative and effective approaches in STEM curriculum and instruction to the region, preparing educators to support all students for work and career in the 21st century. Through successful grant writing, established educator corporate partnerships, as well as partnerships with informal education institutions such as public libraries, the AIU MSC is able to provide research-based mathematics and science professional development aimed at deepening educators' content and pedagogical content knowledge. In 2003, the AIU MSC was granted an NSF Math Science Partnership award (Award ID: 0314914); 1/2003 - 11/30/2010). Rigorous evaluations demonstrated significant improvements in teachers' awareness and understanding of STEM content and effective pedagogies, improvements in classroom practice, and widespread belief that all students can learn math and science, regardless of teachers' prior expectations. The grant also facilitated the development and distribution of 14,000 handbooks to help parents access and understand national standards in math and science. AIU MSC also

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bridged formal and informal learning by licensing the "math + science = success" public awareness campaign developed with an NSF MSP grant to the University of Georgia. Currently, AIU MSC implements a Pennsylvania Department of Education MSP Title IIB grant (Award # FA-075-16-0603) that aims to enhance K-5 teachers' knowledge of the Common Core State Standards in Math (2010) and innovative instructional practices. The professional development was both designed and facilitated by the program director and math coordinator. The Science Coordinator is a NGSS Curator and National Science Teacher Association Facilitator. She served as the principal investigator of the Storytime STEM-packs project, as part of a National Science Foundation Innovation Corp for Learning grant (Award #1546720), which focused on scaling up an educational innovation. AIU MSC also has built relationships with local businesses over the past six years, facilitating educator visits in local corporations, and hosting business/educator panel discussions at their annual *Network Connections Conference*. Having this infrastructure in place allows AIU MSC to effectively collaborate with Partner4Work to recruit participating businesses and school districts and design and conduct an effective program.

Program Facilitator

The program facilitator, Mr. Fierle, is the Director of the AIU MSC, where he supervises a team of STEM education experts to successfully support and improve student achievement in pre-K-12 STEM education. Currently, Mr. Fierle is the project director for a two year PDE Math & Science Partnership Title II B grant that provides resources and professional development for nearly two hundred K-5 mathematics educators and forty administrators in the SWPA region. Prior to coming to the AIU MSC, Mr. Fierle was a supervisor of mathematics, computer science, and business and information technology. His team includes a mathematics and science coordinator, as well as a consultant who is a retired AIU MSC project director. Michael can be contacted at Michael.fierle@aiu3.net or 412-394-4628.

Fiscal Agent

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Local Support

Letters of support for five participating school districts are attached to this application. They include Avonworth, Brentwood, Greensburg Salem, Penn Hills, and Pine-Richland. Teams of educators from each district will participate in six days of professional as described in the Schedule of Activities section.

Business/Industry Partners

Letters of support for five participating businesses/corporations are attached to this application. They include Arconic, the Eaton Corporation, and three PPG locations at Allison Park, Monroeville, and Springdale. Each will be participating as described in the Schedule of Activities section.

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Potential Impact and Sustainability

Participating Educators

40 educators from five school districts will participate in the program. School district administrators will be responsible for recruiting individuals for their team.

Professional Development Credit

Act 48 hours will be provided for all participating educators.

Sustainability

The major work of this educator/corporate partnership does not require direct funding for school districts. This is important since all the work accomplished in this project can and should be embedded into a school's curriculum, and this allows for the work to be sustained and expanded within a school district. This project enhances school districts' capacity to infuse workplace skills and corporate-inspired performance tasks into their curricula and instructional practices.

A second way to sustain the ECP program is through acquiring new corporate funding. In the past, AIU MSC has been able to garner financial support from local corporations for educator/corporate partnerships. With new corporate partnerships acquired through this opportunity, AIU MSC would be able to pursue funding channels to broaden the reach of the program to additional districts in the area.

Lastly, AIU MSC can bring together the district teams and corporate partners from this project to share and discuss the status of their action plans, current obstacles, needed supports, and potential new partnership opportunities each year. AIU MSC will also share the latest resources available for Career Readiness and STEM education as well as our latest courses and workshop opportunities available through the AIU that can lend support to the districts' plans of action.

Program Evaluation Process

Dr. Keith Trahan and members of the Collaborative for Evaluation and Assessment Capacity from the University of Pittsburgh will conduct an external program evaluation. The planned evaluation activities are designed to evaluate the impact of the ECP program on participants' instructional perspectives and practices, as well as provide recommendations for program enhancement.

Specific Evaluation Activities Proposed:

- Survey development and administration
- Round robin format focus groups with three case study district ECP teams during the final professional development session
- Document analysis:
 - Written debriefs and reflections of participants
 - STEM action plans
 - Site visit materials
 - Professional development artifacts