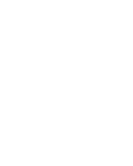
Building a Robust STEM Talent Pipeline in the Great Lakes Bay Region



GLBRA STEM Impact Initiative Summary Report



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Executive Summary

The U.S. has a serious skills shortage. So serious that for the first time in decades, the nation’s standard of living is under threat.

Unlike any other time in U.S. history, retiring workers will cause the working-age population to shrink. What’s more, an aging population is only part of the problem. Lower labor participation rates and stagnant growth in workforce productivity are also to blame1. As baby boomers retire and young people opt out of the labor force2, the talent pool is shrinking fast, and employers across the country are struggling to find workers with the right skills to fill open positions.

national average in math proficiency and the GLBR lags the state math proficiency average. Training providers are doing their best to meet employers’ demands, but there are clear mismatches between what employers need and what training providers are delivering. The upshot: employers who must provide additional training at their own expense and workers who are not getting the skills needed to fulfill the demand.

With the regional demand for STEM talent projected to grow even further, the education system urgently requires a stronger emphasis on STEM competencies, especially in math and science. Indeed, STEM employment, education, and training are critical to the economic prosperity of the region. And with the current and projected

Our education and workforce systems are making matters even more difficult. Approximately 60 percent of first-year college students require remediation and only four percent of students enrolled in two-year programs graduate on time.3 Furthermore, educators and businesses simply don’t concur on how well graduates are prepared for the workforce: 96 percent of chief academic officers say they are, but only 11 percent of business leaders agree4.

In a rapidly changing economy this situation is untenable. Lower productivity, higher training costs and lost revenue all hinder the nation’s global competitiveness. Indeed, the average business foregoes nearly $23,000 per unfilled position5.

Science Technology Engineering and Mathematics (STEM) jobs are critical to the future growth and competitiveness of the

U.S. economy. They help to drive innovation, economic growth and productivity.

Furthermore, STEM jobs are some of the fastest growing occupations in the country, encompassing everything from professional positions to “middle skill” jobs (those that require less than a bachelor’s degree, but more than a high school diploma). They cut across multiple industries, advanced manufacturing, healthcare, computer science, construction and engineering among them.

STEM skills are required to help meet growing demand for such jobs. U.S. students,however, are woefully unprepared. About 97 percent of all STEM jobs require a 7th grade level of math.6 Yet almost 66 percent of U.S. 8th graders are not proficient in math and 28 percent failed to score at even the basic level of math competency.7

The Great Lakes Bay Region (GLBR) is particularly reliant on STEM skills due to the presence of many large STEM employers, especially in manufacturing and healthcare. Its challenges mirror those of the nation— and may even be greater. Michigan lags the

future shortage of STEM talent, the GLBR must address this challenge to maintain the region’s competiveness.

The Great Lakes Bay Regional Alliance (GLBRA), a consortium of business, education, and community interests, launched the STEM Impact Initiative for this very reason. Its task: to conduct a study of the region’s current STEM environment and develop a set of recommendations and a roadmap for building a strong STEM talent pipeline.

The STEM Impact Initiative began with an assessment of the current STEM ecosystem in the GLBR. As a result of this process, four key requirements for a high-performing STEM region emerged. Specifically, a high- performing STEM region must be:

* Driven by Employer Demand
* Powered by Career and College Ready Students
* Focused on Strengthening Technical Skills Needed for the Economy
* Sustained by a Culture of STEM

Driven by Employer Demand

A high-performing STEM region is one in which employers define and communicate their needs to training providers, the K-12 education system and the broader community. If employers do not define and communicate needs, workers are less likely to possess the type or quality of skills employers require. In the GLBR, economic growth has been constrained by an inability to find needed talent, in terms of both the number of individuals with such skills and the quality of those skills. Employers do not use a common language to communicate their job expectations, which makes it difficult for training providers to understand what employers need. In addition, employers do not consistently forecast or communicate demand to training providers. In order to move towards being a high-performing STEM region, employers must specify needed skills and competencies for high- demand positions in a common language, forecast demand, and communicate those needs to training providers.

###### Powered by Career and College Ready Students

kEy ConCLuSionS:

1. The economic vitality of the GLBR depends on industries and jobs that require “STEM” skills.
2. Businesses must speak a common language about the specific skills they require.
3. Education and training systems must produce the STEM talent required to meet and sustain economic growth.
4. The GLBRA requires an effective STEM pipeline if it is to retain existing jobs and attract new businesses.

Inordertobuildandsustainthe GLBRSTEM Talent Pipeline, the STEM Impact Initiative needs to work across business, education, and training. The GLBR will also need to establish a strong regional infrastructure to support the execution of a community- led plan. Effective change will require a community-driven, collective impact effort in which all types of stakeholders participate. Building the STEM talent pipeline will not happen overnight. This is a long-term investment for the region—but with the promise of great returns.

A high-performing STEM region is one in which students are prepared with the foundational STEM skills required to be successful in college and in their careers. In the GLBR, student achievement in STEM subjects lags behind peer communities in the state, around the country and indeed the world. This is partially due to the limited STEM professional development available in schools for existing teachers and within the programs that prepare new ones, constraints on programming and curricula that teach STEM skills effectively, and a misalignment among educators of the importance of STEM education to the region. In order to move towards being a high-performing STEM region, the GLBR must focus on improving the math proficiencies of all students through the use of evidence-based pedagogy, programming, and professional learning opportunities. Additional support must come from the incorporation of STEM-aligned programming that drives increased interest in STEM subjects, especially math and science, both in the classroom and beyond it.

###### focused on Strengthening Technical Skills needed for the Economy

A high-performing STEM region is one in which students have opportunities to develop STEM technical skills in advance of employment, and in which training is aligned to meet employer requirements. Enrollment in the GLBR’s technical skill programs is not sufficient to meet current and future employer demand. Curricula, moreover, are often only loosely aligned with employer needs. And there are significant barriers to both student enrollment in high- demand programs and their participation in work-based learning opportunities. In order to move towards being a high-performing STEM region, training providers must align programming and curricula based on employer requirements, and provide opportunities and incentives to drive enrollment in programs that prepare workers for high-demand, business-critical positions.

###### Sustained by a Culture of STEM

A high-performing STEM region is one in which the entire community believes that developing the STEM workforce is an investment in its own future. There is no common definition of STEM within the GLBR, which has resulted in “random acts of STEM” that are not aligned to a common agenda or objective. Community and business stakeholders are willing to participate in STEM efforts but are not sure how to help, or do not know which programs are effective in improving student outcomes. Students have limited interest in or awareness of potential STEM careers and the pathways required to achieve them. In order to move towards being a high-performing STEM region, the GLBR must be proactive in changing perceptions of STEM and generate awareness of the available career pathways for job seekers and students. Concurrently, financial and academic credit barriers must be removed and incentives created to drive students and job seekers to pursue STEM careers.



ExEcUTIvE SUMMARy 5

# Report Layout

#### The STEM Impact Initiative Summary Report includes the following sections:

###### SETTInG ThE STAGE

This section frames the national skills gap crisis and how it is impacting the GLBR in particular.

###### Why STEM

This section addresses why STEM is critical to the success of the GLBR.

###### REqUIREMEnTS

This section examines each of the four requirements for a high-performing STEM talent pipeline. Within each requirements section, findings, recommendations and strategies are presented. It is important to note that in some cases there is a one-to-one match between a set of findings and a set of recommendations, but in other cases, findings in one requirement are reflected in the recommendations for another. For each requirement area, both the current and desired future state of the GLBR is described.

###### FIndInGS

The findings are based on three months of data collection and research across five counties in the GLBR (Bay, Gratiot, Isabella, Midland, and Saginaw), as well as across the country.

###### REcoMMEndATIonS

Recommendations address gaps or suggest improvements to existing systems and processes with the intent of moving the region towards being a high-performing STEM region. They were designed to provide the GLBR a high impact set of activities possible to create a strong STEM talent pipeline within a short time frame (about two to four years).

###### STRATEGIES

Strategies are the key action items required to execute the recommendations. Specific case studies are included to illustrate concepts in more detail, provide examples of best practices, and indicate which resources are available to the GLBR to support implementation of the strategies.

###### TAkInG AcTIon

This section focuses on the approach the GLBR will need to take in order to turn the strategies into action.

###### cALL To AcTIon

This section is designed to inspire and encourage the GLBR community to become engaged in the STEM Impact Initiative.

# Setting the Stage

#### Nationwide, the education and workforce systems are struggling to keep pace with employer demand. More than five years after the official end of the recession, labor force participation rates remain low and U.S. employers still struggle to find skilled workers. In a recent survey of U.S. executives at large companies, nearly half were concerned they would not have the skills they will need in the next one to two years8.

The focus of the study was to conduct an assessment of the STEM education and workforce system in five counties (Midland, Saginaw, Bay, Isabella and Gratiot). The goal of the project was to provide the GLBRA with a current state assessment of their STEM education and workforce system, as well as with a set of recommendations on how to create a more robust and sustainable STEM talent pipeline to meet current and future demand. The project leveraged

One of the primary drivers of this disconnect

between available talent and employers’ needs is the misalignment between the skills employers seek and those available in the labor pool. Industries that employ large numbers of STEM workers, such as manufacturing and healthcare, are impacted by a shortage of graduates with STEM skills and degrees. In a nationwide survey, more than 80 percent of manufacturers reported a moderate to severe shortage of highly skilled manufacturing process workers9. This misalignment has real impacts on companies’ performance. Skills shortages increase production costs, leading to revenue and profit losses—a serious blow to bottom line results.

To bridge the growing gap in STEM talent, employers have often responded by sourcing talent from outside their region, either domestically or abroad. Foreign-born workers account for 17 percent of all STEM workers, versus 12 percent of the labor force as a whole10. When needs cannot be met, employers may consider relocating STEM- dependent operations to regions where talent is more readily available. It is therefore critical for regions to develop their work- forces if they are to remain competitive, retain their existing employer base and attract new entrants.

As a region with a high dependence on STEM

talent, the GLBR is significantly affected by the skills gap, especially in regards to a shortage of in-demand STEM degrees. Across several hard-to-fill positions11, like Computer Numerical Control (CNC) Operators and Occupational Therapy Assistants, the GLBR employs workers at nearly twice the national average. With an increasingly competitive global STEM economy, the education, business, and broader communities must work together to meet these challenges. With the demand for STEM talent expected to grow, now, more than ever, is the time to take action.

###### Launching the STEM impact initiative

The STEM Impact Initiative is a community- based effort focused on building a strong STEM workforce to sustain and grow a vibrant economy in the GLBR.

As the STEM Impact Initiative’s first step, the GLBRA commissioned a study to understand more about growing STEM careers in the region. Accenture and Innovate+Educate conducted the study over a five-month period beginning in May 2014.

both quantitative and qualitative analysis, undertaking interviews, surveys, customized real-time labor market data and research, as well as facilitating three community- wide working sessions. Community stake- holders including local business leaders, teachers and school administrators, higher education deans and presidents, workforce development representatives, economic developers, civic leaders and regional community funders were involved throughout.

Between May 2014 and August 2014, the project team:

* Interviewed more than 150 key stakeholders
* Led five focus groups with K-12 teachers, principals, curriculum directors, and college access organizations
* Conducted eight surveys with over 1,500 responses
* Performed economic and workforce analysis using leading labor market intelligence tools
* Researched national best practices and gathered leading case studies from other regions
* Held three meetings with community leaders to solicit input on findings and recommendations as to how to build community engagement around the STEM Impact Initiative

The STEM Study was a data-driven process based on an analysis of the GLBR against national best practices that form the requirements for a robust STEM Talent Pipeline. The research team investigated top performing STEM states including California, Iowa, North Carolina, Ohio, Tennesee, Texas, Utah and Washington, as well as interviewing leading STEM nonprofits, the STEMx network of member states, and STEMConnector, the one-stop shop for STEM information.

The assessment examined the region’s current practices and overall effectiveness across the education-to-employment continuum, focusing on four critical components for building a thriving STEM economy:

**Driven by Employer Demand –** A high performing STEM region is one in which employers define and communicate their needs to training providers, the K-12 education system and the broader community. As business needs continue to evolve, the new requirements are quickly reflected in training delivered to workers.

**Powered by Career and College Ready Students –** A high-performing STEM region is one in which students are equipped with the foundational skills needed to pursue STEM degrees and careers. Teachers are empowered to excite students and deliver a strong STEM education, and there is a steady supply of high quality STEM educators coming into the system.

STEM iMPaCT iniTiaTivE GoaL:

To build the workforce of tomorrow through comprehensive STEM education and training to meet the growing needs of current employers and to attract new jobs and companies to the Great Lakes Bay Region.

**Focused on Strengthening Technical Skills Needed in the Economy –** A high-performing STEM region is one in which technical skill training providers offer training that is aligned with employer requirements and provides students with opportunities to learn STEM skills in advance of employment. Students have the opportunity to participate

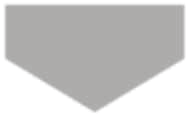
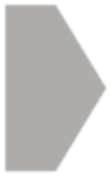
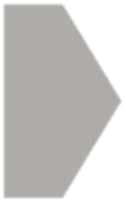
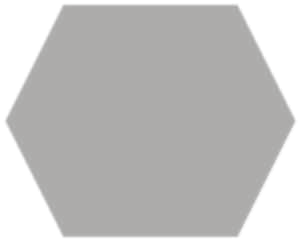
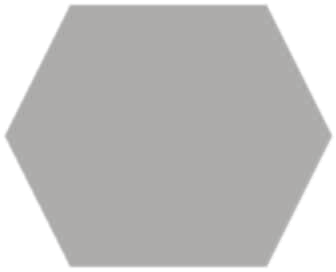
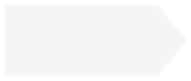
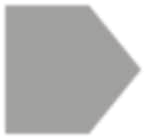
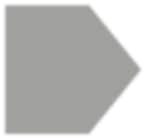
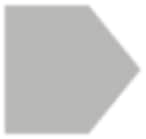
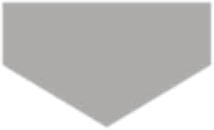
in focused, experiential learning opportunities that build skills while giving the student an understanding of what life would be like in a particular career.

**Sustained by a Culture of STEM –** A high- performing STEM region is one in which STEM is considered the engine of economic growth and enjoys community support. Funding and incentives are offered to drive the most effective programs to achieve the community’s STEM goals.

Taken together, these four components form the basis of a STEM talent pipeline that drives economic development through educational attainment.

FIGURE 1

Requirements for an Effective STEM Talent Pipeline



Powered by

**Career & College Ready Students**

Focused on

**Strengthening Technical Skills Needed in the Economy**

Driven by

**Employer Demand**

Sustained by

**Culture of STEM**

Why STEM for the GLBR?

#### STEM offers the GLBR an opportunity to build a growing and vibrant economy. The GLBR is a historically strong STEM region, sustained by some of the largest and most prominent STEM companies in the world. STEM industries within the GLBR are expected to see strong growth across the region in the next ten years, and the jobs generated will pay higher wages than non-STEM occupations. Certain industries, such as manufacturing, have a “multiplier effect,” creating jobs beyond the industry and thus fueling more economic growth. The GLBR has a strong manufacturing base, which it can leverage to attract new businesses and further develop the STEM economy. over the long term, regions with a strong STEM workforce can generate a higher standard of living, as well as long-term economic growth and stability.

###### Current and historical focus on STEM in the GLBR

A STEM-focused economy drives the GLBR. Figure 2, to the right, shows that two primary industries—manufacturing ($1.8B), and health- care ($1.3B)—drive 39 percent of the region’s

$3.58B GDP. Since a large percentage of their workforces requires STEM degrees and/or STEM skills to fill positions, these industries are considered STEM industries12.

FIGURE 2

### Top 6 GLBR Industries by GDP (2012)

###### (GDP in millions)

$1,817

Manufacturing Healthcare and

$1,267

$905

$710

$542

$497

Social Assistance

Retail Trade Real Estate and Rental Leasing

Finance and Insurance

Professional, Scientific, and Technical Services

These two industries also account for the majority of STEM jobs in the region: manufacturing for 16.1 percent of jobs, and healthcare for 36.8 percent. Moreover, they represent many of the region’s largest employers, including 7 employers with more than 2,000 employees (see Figure 3).

Within these key industries, GLBR employs

FIGURE 3

Dow Chemical

**# of FTE in GLBR**

**Company Name**

Dow Corning (including Hemlock Semiconductor)

Nexteer Automotive

5,300

4,461

4,200

STEM talent at a higher rate than the rest of

the country. Location quotient analysis is a measure of how concentrated a particular occupation is in a region compared to the

Covenant Healthcare

4,129

manufacturingandhealthcare. Theoccupations in Figure 4 represent the most in-demand

|  |  |  |
| --- | --- | --- |
| nation as a whole. For the GLBR, occupations | MidMichigan Healthcare | 2,979 |
| such as CNC Operators13 and Occupational Therapy Assistants are in-demand at more | St. Mary’s of Michigan | 2,200 |
| than twice the national average14. The |  |  |
| majority of these occupations are within | McLaren - Bay Region | 2,016 |

STEM occupations in the GLBR, compared

to the national average.

###### Projected future growth of STEM jobs

FIGURE 4

### GLBR Top STEM Occupations by Concentration

2.17

Not only does the GLBR currently rely heavily on STEM talent, but economic forecasts also project an even more STEM- dependent economy in the future. Both the Bureau of Labor Statistics (BLS) and Bureau of Economic Analysis (BEA) say that STEM occupations will fuel future job growth in the region. Indeed, between 2014 and 2020, nearly all STEM occupations in the region are expected to see growth, with healthcare and computers/math occupations leading the way with expected growth rates of 14 percent and nine percent, respectively.15

**National Average**

**1.0**

2.07

1.89

1.75 1.7

1.52

Location Quotient

1.39

###### Promising economic prospects for STEM industries and jobs

STEM industries, especially manufacturing,

CNC

Occupational

Physical Therapy Speech Language

Manufacturing

Welder/

Industrial

have strong potential to fuel economic growth through higher job growth, employment, wages, patenting and exports16. Industries that offer a high percentage of STEM jobs often indirectly create additional jobs and generate GDP beyond their industry.17 In addition, most STEM-oriented regions have been shown to perform strongly across a number of economic indicators and can improve the overall standard of living in the region through higher-than-average wages.18

Operator

Therapy Assistant

Assistant

Pathologist

Engineer

Solderer

Engineer

10 BuiLDinG a RoBuST STEM TaLEnT PiPELinE in ThE GREaT LakES Bay REGion

GIvEN ThE STRoNG STEM-foCUSEd EMPLoyER BaSE, ThE fUTURE ECoNoMIC SUCCESS of ThE GREAT LAkES BAy REGIon IS hIGhLy dEPENdENT oN SkILLEd STEM TaLENT.



Why STEM foR ThE GLBR? 11

# Requirement: Driven by Employer Demand

#### “Education needs to be in tune with the job market - otherwise we are training something that isn’t going to be there” – Regional Manufacturer

as the labor supply tightens across the country, communities, industries and businesses are competing in a “battle for talent.” Businesses will move to where talent is plentiful, especially when talent is hard to find. In order to be competitive and seize growth opportunities, the talent supply in the GLBR must be aligned and responsive to employers’ STEM demands.

A high-performing STEM region is one in which employers define and communicate their needs to training providers, the K-12 education system and the broader community. As business needs continue to evolve, new requirements are quickly reflected in training delivered to workers. This creates an environment where retraining costs are minimized, worker productivity is maximized, and talent supply and demand are tightly matched.

DRivEn By EMPLoyER DEManD kEy finDinGS:

1. Economic growth is constrained by challenges finding qualified STEM talent.
2. Employers struggle to find STEM talent due to a lack of technical skills, soft skills and required experience.
3. It’s difficult to get a clear picture of the region’s talent needs because of a lack of transparency around current and future (short-term) demand.
4. Employer job expectations are confusing because they do not talk about skills and competencies in a common language, or one used by educators.

###### Finding #1: Economic growth is constrained by challenges finding qualified STEM talent

According to the GLBR STEM Employer Survey, a regional survey of GLBR employers19:

* + Approximately 53 percent indicated that applicant availability has prevented them from developing new products or services.
  + Approximately 41 percent indicated that their overall productivity had declined as a result.
  + Approximately 35 percent reported a reduction in production output or sales.

In addition to constraining the growth of businesses in the GLBR, challenges in finding qualified STEM talent also deter companies seeking to enter the region. According to interviews with regional economic development groups, two of the biggest factors that companies consider when choosing to open new facilities are the current

availability of talent and the education system in place to fuel the talent pipeline. Regional economic development organizations have cited talent as a frequently mentioned obstacle among companies considering the GLBR as a site location.

#### “We haven’t had the luxury of a surplus workforce as an incentive to attract employers.”

– GLBR Economic development organization

###### Finding #2: Employers struggle to find STEM talent due to a lack of technical skills, soft skills and required experience

The GLBR STEM Employer Survey also found that employers were unable to find employees with the right experience, not only in terms of technical skills but also in terms of “soft” or workplace skills such as the ability to work in teams, personal organization, and communication skills20 (see Figure 5).

This issue is not unique to the GLBR. Across the country more than 75 percent of manufacturers report a moderate to severe shortage of skilled resources, and over 80 percent of manufacturers report a moderate to severe shortage in highly skilled manufacturing resources21.

FIGURE 5

Key Employer Survey Results

71% of employers reported having difficulty hiring for a STEM job within the last 12 months1

71%

76%

65% of employers reported that sufficient experience is not easy to find1

65%

52%

76% of employers reported that for their most in- demand positions, trained talent is difficult to find1

52% of employers have difficulty finding workers with the soft skills needed to be successful in the workplace1

#### “There are people to hire, but not necessarily good employees” – Regional Employer in healthcare

###### Finding #3: It’s difficult to get a clear picture of the region’s talent needs because of a lack of transparency around current

and future (short-term) demand

Across the region, STEM jobs are posted through a variety of channels and a diversity of locations. The lack of a single, common method and location for posting jobs across employers means that employer associations, training providers, workforce development agencies and workers do not have a clear picture of current demand.

This inconsistency is partly responsible for the region’s inability to aggregate or distribute short-term demand routinely.

The GLBR STEM Employer Survey found that 27 percent of companies do not post jobs online. In some cases, employers will only create one posting, even if they are looking to hire for multiple positions, and this creates challenges in accurately representing aggregate numbers. Additionally, more than 90 percent of employers use word of mouth to advertise open positions, making it even harder to understand the region’s talent needs22.

Acrossallinterviewsheldwithemployersand industry associations, only one organization had a recurring process to aggregate demand and no education provider mentioned receiving demand forecasts or needs from employers23. Without a clear picture of demand, it is hard for education and training providers to determine how to respond to employer needs.

#### “We can’t send clients to employers if they don’t post the available jobs” – Workforce development center

“We need businesses to tell us what skills and competencies are necessary for a high school graduate to be job ready” – ISd Superintendent

###### Finding #4: Employer job expectations are confusing because they do not talk about skills and competencies in a common language, or one used by educators

Employers do not uniformly communicate the skills and competencies required for jobs, which makes it difficult for job seekers and training providers to develop the in-demand skills required by the market. Additionally, if the jobs are posted in multiple places, job seekers may not find all of the jobs they could apply for, and the employer could be missing out on a potentially larger talent pool. Furthermore, businesses and educators frequently interpret language differently. A recent example of this miscommunication occurred at one of the STEM Impact Initiative community meetings. While discussing the meaning of “high achieving,” educators interpreted “high achieving” to indicate a student who took Advanced Placement (AP) or International Baccalaureate (IB) classes while employers interpreted “high achieving” to indicate a worker whocancompleteataskwithminimal supervision and who has the potential to progress up the career ladder. This exchange is an excellent example of how the lack of a common language leads to unintended confusion and decisions based on a misunderstanding of intent.

RECoMMEnDaTion in aCTion: aSC-GiEC

arizona Sun Corridor – Get into Energy Consortium (aSC-GIEC) provides a best-practice example of existing industry associations collaborating with employers and community colleges to develop a best-in-class curriculum based on skills and competencies. aSC-GIEC is a partnership of educational institutions and industry stakeholders dedicated to being responsive to the workforce needs of regional energy suppliers.

Building off industry demand, the consortium has developed a demand- driven community college system using an eight-tiered set of stackable credentials custom tailored for the energy industry. aSC-GIEC developed its curriculum with heavy input from energy company partners. The curriculum is intended to establish a collective baseline for students across all five community colleges.

Realizingthatspecializedtrainingfollowingtheseeightstackablecredentials would likely be proprietary and therefore the employers’ responsibility to administer, aSC-GIEC focuses its efforts on developing students that are job- and industry-ready rather than trained to a specific company’s specifications or specialized tasks. By hiring employees with a common set of industry-defined core competencies aSC-GIEC businesses are able to reduce the time and costs associated with onboarding and immediately focus on job-specific training.

###### Driven by Employer Demand: Recommendations

Research and interviews with GLBR stake- holders revealed two primary issues hindering the GLBR’s ability to be driven by employers’ STEM demand. First, there is a lack of common language in how employers and training providers describe skills and competencies. This results in training providers who do not have a good understanding of what skills and competencies employers need.

Second, poor visibility into job postings and a lack of aggregate demand forecasts result in training providers who are unsure of how many and what type of degrees are needed to meet employer demand.

In order to empower training providers, businesses must define the STEM skills and competencies needed for an employee to perform job duties and communicate those needs to training providers. This will enable alignment between training providers’ programming and employer needs. Once training providers understand the specific skills required and the number of workers needed with those skills, they can adjust programming and align capacity to employer needs. In addition, existing workers and potential candidates can be better evaluated against specific job needs. When workers

have strong foundational skill sets, employers can reduce training and more quickly adapt to changing business needs. By hiring employees with a common set of industry- defined core competencies Arizona Sun Corridor employers were able to reduce the time and costs associated with onboarding and immediately focus on job- specific training (see Arizona Sun Corridor case study).

**Recommendation 1:** Specify needed technical and workplace skills and competencies for high-demand positions

Historically, employers have relied on job postings and descriptions to signal require- ments to job seekers and training providers. Training providers have interpreted hiring decisions by employers as a sign of training satisfaction. This business-as-usual process

is inefficient and results in employers who can’t find the talent they need, jobseekers who are debt-ridden and unable to find employment, and training providers who are unable to understand the effectiveness of their STEM training. To address this issue, businesses and educators, through formal partnerships, should work together to develop a mutual understanding of what a job requires and to define what specific skills and competencies are needed.

STRaTEGy in aCTion: SMaRTaLEnT

The national institute for Standards and Technology’s Manufacturing Extension Partnership (MEP) is developing a technology tool called SMaRTalent (Strategic Management acquisition and Retention of Talent) that will help manufacturers to operationalize their workforce development strategies and automate basic tasks. as manufacturers focus on workforce planning and investment, the SMaRTalent tool can help them operationalize those investments.

SMaRTalent can be used for job profiling, want ads, workforce diagnostics, competency and skill identification, workflow planning, lay-off aversion and succession planning. It will also automate functions for these activities. for employers who have traditionally struggled to post jobs, the SMaRTalent tool offers an automated wizard to post open positions directly to several job boards.

*Strategies*

**Strategy A:** Bring together employers to identify in-demand skill sets and

competencies and develop representative job profiles

Businesses that utilize similar skillsets or positions should work together to define skills and competencies as well as to create representative job profiles. Representative job profiles can be used to communicate job requirements to training providers and job seekers. Existing industry or trade definitions should be used to maximize transferability of skills for workers with employers outside the region. Through development of representative job profiles, employers develop a better understanding of shared talent needs across employers and are better equipped to engage training providers to adapt programming.

**Strategy B:** Develop a standardized approach to defining skill requirements on an ongoing basis and build support for this approach within the employer community

Industry associations, trade unions, individual employers and training providers should develop a standardized process for definingskillsandcompetencies. Developing this approach will allow consistency between employers and across skill areas so that training providers have a common language and level of detail to adapt to. Where possible, existing processes, tools and national best practices should be used to streamline this effort. One existing resource to explore is the U.S. Department of Labor Competency Models, which detail needed baseline skills across a variety of skill sets and industries, including technical and soft skills. Once an

approach has been developed, employers are able to use a repeatable process across companies to define skills and competencies in a common and streamlined format.

**Strategy C:** Build a standardized process by which employers regularly communicate skills and competencies to skill providers

Once employers are regularly evaluating their needed skills and competencies, these job requirements must be communicated to training providers. A recurring process should be designed to allow the formal communication of these requirements. This process may rely on a technology-based platform or may be developed to involve regular formal review sessions with training providers. Having up-to-date employer requirement information will allow training providers to adjust programming and curricula to meet employer needs.

**Recommendation 2:** Forecast and aggregate employer demand

Historically, businesses have forecasted inconsistently from company to company, in part because they believe it requires a significant investment for little return. However, forecasting can be a boon to businesses and does not necessarily require a major effort. Employers can make

forecasting more manageable by limiting their focus to those high-demand positions which are hard-to-fill and critical to business success. By restricting forecasting to such high-demand positions, data gathering can be completed in a rapid and concise manner without burdening employers or requiring long lead times. When this demand is aggregated across employers and industries, the forecast becomes more useful to training providers and job seekers. If employers communicate demand on a regular basis, training providers are empowered to adjust program capacity and pipeline based on regional employer needs instead of on macro-economic forecasts.

*Strategies*

**Strategy A:** Convene industry organizations to take the lead on industry-specific aggregation efforts

Therearemanyindustryortradeassociations in the GLBR and forecasting efforts are already occurring in pockets. These existing organizations and partnerships should be expanded to execute forecasting efforts more effectively. For skillsets without existing employer partnerships, new partnerships should be forged. Forecasting should be focused on common skillsets required by employers, regardless of industry affiliation.



By using existing organizations to lead aggregation efforts, costs are lowered, a larger member base becomes accessible and existing tools can be better leveraged.

**Strategy B:** Develop survey tools that industry organizations can use to gather employer forecasts

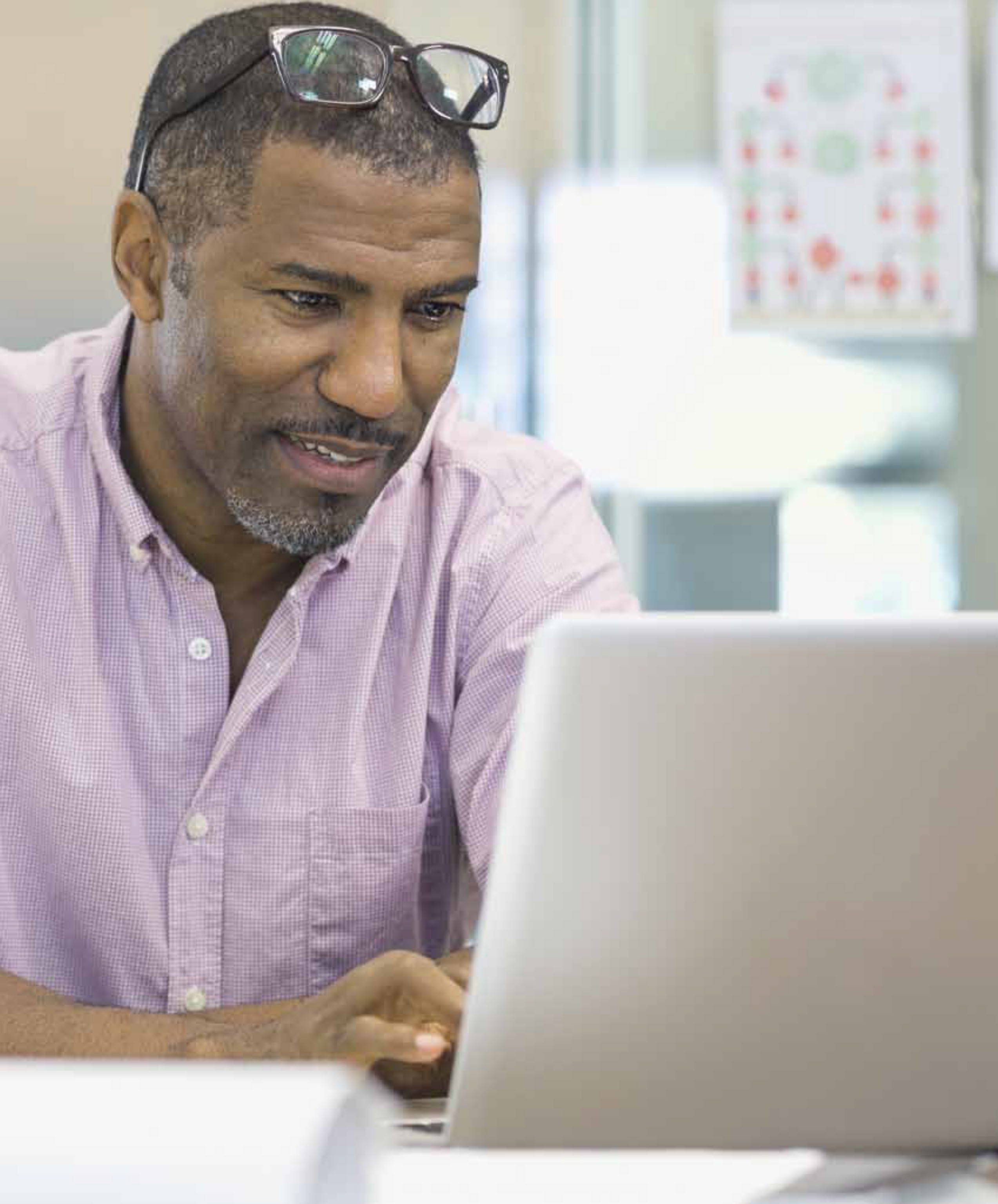
Technology tools, such as online surveys, can allow employers to develop and provide their forecasts in a standardized manner. The GLBR should develop standard survey tools to enable employers to forecast demand. Existing surveys, such as those developed by the Great Lakes Bay Manufacturers’ Association, should be leveraged and used as a starting point. Online tools will allow easy communication of forecasting requests, as well as access to and aggregation of data. Additionally, tools such as the Manufacturing Extension Partnership’s SMARTalent (see Smart Talent case study) help employers develop strategies for their workforce needs and ease the creation and posting of standardized job profiles.

**Strategy C:** Aggregate demand, supplement with external labor market data, and communicate results

Once employers have made their current and future needs known, demand should be aggregated across skill sets and industries. Utilizing technology tools, aggregated demand forecasts should be determined for each of the in-demand skill sets. External labor market and forecasting data can be used to validate or challenge employer forecasts. They can also act as a backfill for employers who do not submit forecasts. When results show discrepancies, additional analysis should be performed to understand the root cause of the variance. Forecasts can then be adjusted if needed. Once forecasts havebeenvalidated, demandforecastshould be communicated to training providers. Communicating aggregate demand to training providers allows program capacity and marketing efforts to be adjusted. One way to enable easy aggregation of demand without surveys is to encourage the posting of jobs listings to a common location. Promoting the use of MiTalent.org will help provide a single window into demand and make it easier for job seekers, training providers and workforce development agencies to respond to employer needs.

**Strategy D:** Support efforts to enable continuous demand forecasting, aggregation and communication to training providers

Once an effective forecasting process has been developed, it should be standardized across additional priority skill areas and industries. By developing a tool that is skill set- or industry-agnostic, additional high-demand skill areas can quickly be integrated. Ideally, demand forecasts would be provided over a timeframe that correlates to the time it takes to train a worker and sync up with appropriate enrollment periods. Ongoing forecasts and communication will provide training providers with up-to-date, actionable information to adjust program capacity and drive enrollment.



REQUIREMENT: DRIVEN BY EMPLOYER DEMAND **17**

# Requirement: Powered by Career and College Ready Students

#### “We need to foster scientific inquiry and mathematical process from the start.”

- Great Lakes Bay Region Superintendent

Students are the foundation upon which a robust STEM talent pipeline sits. a high-performing STEM region is one in which students are equipped with the foundational skills needed to pursue STEM degrees and careers. In order for the GLBR to become a thriving hub of STEM talent, the k-12 education system must produce students with strong STEM skills and competencies, especially in math and science. It must also provide effective curricula and programming, in and beyond the classroom, which promote STEM literacy, empower teachers to excite students and deliver a strong STEM education, and have a steady supply of high-quality STEM educators coming into the system every year.

###### Finding #2: Current student achievement levels in key STEM skill areas indicate that the GLBR will be challenged to produce a strong STEM workforce pipeline

Compared to the rest of the world, and especially other industrialized nations,

U.S. students have below-average math proficiencies. In a 2012 Program for International Student Assessment (PISA) examination of math literacy, the U.S. ranked 35th out of 65 countries in the proportion of 15-year-old students who were highly competent, scoring at proficiency level 5 and above.26

###### Finding #1: Strong math, science and literacy skills are the core competencies required for a strong STEM workforce

Nearly 97 percent of all STEM jobs require foundational math skills with most requiring proficiencies by 7th grade24. This makes math one of the foundational building blocks for a child’s future success. Like literacy, numeracy is a critical skill that children must develop throughout their education. Early exposure

to math courses has been shown to influence high school students’ interest in studying STEM fields25. In addition, early math achievement influences students’ belief that they can succeed in math, which, in turn, influences whether students choose to pursue STEM fields.

Within the U.S., Michigan ranks poorly among its peers in both math and reading. Based on the National Assessment of Educational Progress (NAEP) scores, Michigan students have below-average math and reading proficiency levels compared with average U.S. proficiency levels. In 8th grade reading and 8th grade math, Michigan ranks 32nd and 38th respectively, while in 4th grade reading and 4th grade math, Michigan ranks 38th and 42nd, respectively.

#### “… Math and science form the foundation for innovation. fluency in math is needed to understand science, and science creates the innovations that will help solve the challenges we face…”- Julie dunkle, U.S. Education Project Manager for Intel



PoWERED By CaREER anD CoLLEGE REaDy

STuDEnTS kEy finDinGS:

1. Strong math, science and literacy skills are the core competencies required for a strong STEM workforce.
2. Current student achievement levels in key STEM skill areas indicate that the GLBR will be challenged to produce a STEM workforce pipeline.
3. School administrators and teachers are not always aligned on the STEM agenda.
4. There is limited measurement of STEM programming effectiveness
5. There is limited STEM-focused professional development.
6. The overall teacher pipeline is declining in volume.
7. Students who are not economically disadvantaged perform better in school but there is an equal opportunity to improve achievement for all students
8. Pre-kindergarten programming is an important opportunity for overall child development but has no conclusive direct correlation to STEM achievement.

Within the state, GLBR schools perform, on average, slightly below the state mean in 4th and 8th grade math achievement (see Figure 6, below). For 4th & 8th grade reading and 5th & 8th grade science, the GLBR performed in line with the state average (see Figure 7, below). It is worth noting that Midland Educational Service Agency schools performed significantly above their regional peers and statewide averages in all analyzed categories.

To meet current and future STEM demand, student achievement in math and science will need to improve significantly. A high- performing STEM pipeline requires a high percentage of students who are not just meeting the standards, but also consistently exceeding them.

A critical downstream impact of low math achievement can be seen in the high volume of students who require math remediation as incoming college freshmen at local higher education institutions. Approximately 36 percent of high school students entering

college require math remediation—13 percent higher than the national average27. Additional course requirements to improve math proficiency can act as a barrier to students pursuing a STEM career as they add both cost and time to degree completion. Remedial students are also more likely to drop out of college without a degree. Fewer than half of remedial students complete their recommended remedial courses. Less than 25 percent of remedial students at community colleges earn a certificate or degree within eight years28.

FIGURE 6

At or Above Math Proficiency

2013 MEAP 4th Grade Math Low Proficient and Above 2013 MEAP 8th Grade Math Low Proficient and Above

60 60

Michigan Average 4th Grade Math

41%

56%

40 Proficiency (45%) 40

38%

Michigan Average 8th Grade Math Proficiency (35%)

20 20

28%

33%

34%

53%

0

Bay-Arenac Gratiot-

Isabella

Midland Saginaw

28%

0

Bay-Arenac Gratiot-

Isabella

Midland Saginaw

FIGURE 7

### At or Above Science Proficiency

2013 MEAP 5th Grade Science Low Proficient and Above 2013 MEAP 8th Grade Science Low Proficient and Above

30 30

30%

20 20

Michigan Average 5th Grade Science Proficiency (17%)

16%

20%

17%

20%

Michigan Average 8th Grade Science Proficiency (20%)

10 10

12%

26%

14%

0

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Isabella

Midland Saginaw

0

Bay-Arenac Gratiot-

Isabella

Midland Saginaw

“50 percent of our incoming students require some kind of math remediation. for a student who is interested in pursuing a STEM path, that can add two more years to a four-year degree track. That turns a lot of students away from those tracks.” - higher Education official

###### Finding #3: School administrators and teachers are not always aligned on the STEM agenda

Surveys of superintendents, principals, and teachers showed that these groups are not aligned on the importance of STEM. When asked how important STEM is in their schools, more than 85 percent of superintendents29 believed STEM to be very important, versus 52 percent of principals and 28 percent of teachers30. Similarly, when asked about the importance of student achievement in STEM subjects to future success, 70 percent of principals said it is very important versus only 44 percent of teachers. The only question on which teachers and principals did agree was regarding the effectiveness of STEM instruction in their schools: 77 percent of teachers and 77 percent of principals believe their STEM instruction to be only slightly to moderately effective.

###### Finding #4: There is limited measurement of STEM programming effectiveness

About 72 percent of principals said they did not have specific metrics for measuring the effectiveness of STEM programming. Of those who are measuring effectiveness, most were using measures of student interest in STEM subjects and enrollment to completion metrics for STEM programs, instead of student achievement or proficiency data. Similarly, among STEM initiative funders in the region, there was limited tracking of program effectiveness beyond dollar spending and students impacted; very little data regarding program impacts was available.

###### Finding #5: There is limited STEM-focused professional development

Most teachers reported that fewer than a quarter of their professional development hours were spent on topics related to STEM subjects and teaching techniques includ- ing project-based learning. This is largely due to a lack of opportunities; 66 percent of teachers reported that their school districts do not provide STEM professional development opportunities. In addition, project-based learning is not used extensively in the classroom; only 43 percent of principals said it is used in the classroom, even though 97 percent of teachers believed project-based learning to be an effective teaching method.

#### “We don’t use the data we have to our advantage” – Superintendent

“No one is telling people good in science and math to go into teaching. There are no incentives for qualified people to pursue that career track, especially if they have to go into debt to do it.” - Superintendent

###### Finding #6: The overall teacher pipeline is declining in volume

Based on National Center for Education Statistics data for conferred college degrees, there is a steady decrease in enrollment in teacher training programs across the region31

FIGURE 8

### Undergraduate enrollment by major

(Alma College, Central Michigan University, Saginaw Valley State University)

4,500

(See Figure 8). Although enrollment in STEM majors has seen an increase in recent years, there are many disincentives for this group to become teachers, including pay disparities, student loan debt, and a poor perception of the teaching profession.

Finding #7: Students who are not economically disadvantaged perform better in school but there is an equal opportunity to improve achievement for all students

Economic status is a major factor in student achievement, yet students across all socio- economic levels are not meeting state proficiency standards. As a region, economically disadvantaged students scored

25 percentage points lower than their economically advantaged peers in 8th grade math proficiency (see Figure 9, below). However, significant numbers of students who are not economically disadvantaged are also not proficient in math.

4,000

3,500

3,000

2,500

2,000

1,500

1,000

500

0

Business

Education

STEM\*

1996 1998 2000 2002 2004 2006 2008 2010 2012

FIGURE 9

2013-2014 % Proficient in 8th Grade Math 2013 # of Students Not Proficient in 8th Grade Math

100%

50%

0%

22%

15%

35%

27%

1000

900

800

700

600

500

400

300

200

100

0

Not Economically Disadvantaged

Economically Disadvantaged

Bay-Arenac Gratiot-

Isabella

Midland Saginaw

Bay-Arenac Gratiot-

Isabella

946

564

504

387

321 311

246

188

Midland Saginaw

###### Finding #8: Pre-kindergarten programming is an important opportunity for overall child development but has no conclusive direct correlation to STEM achievement

According to U.S. Census data, a large percentage of GLBR 3- and 4-year-olds are not enrolled in pre-K programs. Among those who are enrolled in such programs, nearly 40 percent attend private early education programs, potentially leaving out large percentages of low-income children32 (see Figure 10). There is an opportunity to increase the number of 3- and 4-year- olds enrolled in pre-K within the GLBR. However, while many pre-K programs have

fIGURE 10

2013 # of Students Not Proficient in 8th Grade Math

100%

**52%**

**57%**

**47%**

**43%**

**43%**

**23%**

**23%**

**24%**

**14%**

**16%**

**34%**

**34%**

**27%**

**29%**

**34%**

90%

80%

70%

60%

50%

40%

30%

20%

10%

0%

Isabella Gratiot Midland Saginaw Bay

% of 3- and 4-year-olds not enrolled in School

% of 3- and 4-year-olds enrolled in School (Private)

% of 3- and 4-year-olds enrolled in School (Public)

been shown to have positive cognitive development impacts for young children, these effects decline over time, with long- term effects only half the size of initial impacts33. Currently, there is no conclusive evidence to make the connection between pre-K attendance and STEM achievement or pursuit.

###### Powered by Career and College Ready Students: Recommendations

The education system must focus on preparing students for success in both college and careers. The findings highlight a series of gaps that are preventing the region from producing the kind of high-quality STEM talent it needs. All students in the region must have higher math proficiency, teachers must be given the right support to teach math effectively, and programs in educational settings must be grounded in proven strategies that build interest and competencies. By combining these components, the GLBR can produce students who are not only interested in and excited about STEM, but who are also academically positioned to be successful as they progress through their education.

**Recommendation 1:** Improve 5th-8th grade math achievement

The focus on 5th-8th grade math is specifically aligned to two key insights: first, that 97 percent of all STEM jobs require math proficiency at the 7th grade level; and second, that success in algebra is the critical gateway for a student’s future success with higher levels of math. Improvement in math achievement requires a holistic approach that combines the “how” (pedagogy), the “what” (curriculum) and the “when” (in classroom, after school, outside of school, etc.) in order to improve a student’s ability not only to understand math but also to excel at it. Teachers are a critical lynchpin in a student’s success. For teachers to be successful, they must have the proper training and continued professional learning in methodologies that have been proven effective in increasing students’ math proficiency. Curricula and programs used in the classroom must be based on research demonstrating positive math outcomes. Finally, high-quality and consistent exposures to STEM opportunities outside the class- room are critical to math improvement.

*Strategies*

**Strategy A:** Provide research-based, proven professional learning programs for 5th – 8th grade teachers based on best practice pedagogies that are proven to increase student achievement

As noted in the findings, teachers need STEM-focused professional learning opportunities that provide them with strategies and tools to teach math effectively to their students. GLBR should have a common set of professional development programs that teach proven methods for engaging students in math. A list of options for consideration has been provided to the GLBRA Education Council. As a result of this focused attention, teachers will be more comfortable and adept at finding the right way to help a child understand key math concepts and strengthen their math comprehension.

**Strategy B:** Develop and implement a structured process of data-driven formative assessments and use research-based interventions to address gaps in student learning with appropriate support resources in the form of curriculum coaches and math specialists

STRaTEGy in aCTion: uTEaCh

The uTeach institute was established in response to national concerns about the quality of k-12 education in the areas of science, technology, engineering, and mathematics and to grow interest in the innovative teacher preparation program started in 1997 at The University of Texas at austin (UT austin).

The philosophy underlying the design of the UTeach Instructional program isthatbycombiningindividualizedcoaching, intensiveteachingexperiences in k-12 classrooms, and relevant STEM content, students’ knowledge and skills will develop at an accelerated rate. This approach translates into a curriculum, unique in content and sequence, that allows students to obtain a STEM field degree and a secondary teaching certificate.

The UTeach Institute now partners with 40 universities, including UT-austin, to implement UTeach programs across 19 states. from fall 2008 to fall 2013, national student enrollment in UTeach programs grew from 519 to more than 6,900. The Institute projects it will have 9,000 graduates and those teachers will impact 4.8 million students by 2020.

A standardized process for assessment and intervention is required for use among all 5th-8th grade math teachers. The process should use the data available from previous MEAP tests to derive a clear understanding of where each student needs to focus. The starting point for this effort should be an analysis of previous MEAP scores and identification of questions that 30 percent or more of students got wrong. Using that information, teachers should identify specific intervention programs that can be used with the students to improve in those areas. As part of the STEM Study, the research team generated a list of evidence-based math programs that teachers can use to help students enhance their math comprehension in their target areas. This list has been provided to the GLBRA Education Council. Using a standardized process that is data-driven and targeted to meet the needs of the students enables teachers to be more effective in what they are teaching and allows students to focus on what requires the most attention.

**Strategy C:** Establish agreed math improvement measures that will be used across all school districts

In K-12 stakeholder interviews with principals and superintendents, MEAP scores were the only consistent measure used by all school districts to determine student performance. However, given the forthcoming changes with a new set of standards under the Common Core, many voiced concerns over the use of MEAP scores as the only measure. A new way to measure math improvement must be identifiedandagreeduponbyallschooldistricts in order to ensure that students’ math proficiency is improving. A small group of representative K-12 stakeholders (super- intendents, principals, teachers, curriculum directors) needs to work together to agree upon a set of measures and baseline data

that will be used by all school districts to track, measure and report on student math achievement. By aligning on a shared set of metrics and measures, the school districts can clearly show a connection between their actions and student outcomes.

**Strategy D:** Integrate research-based programs at colleges of education that increase math pedagogy for incoming teachers

Providing professional development programs only addresses the existing teacher workforce. To maximize effectiveness, additional research-based programs which increase math pedagogy should be integrated into colleges of education. Having teachers who are comfortable teaching math (and other STEM-related subjects) is a critical component of a holistic approach to improving math achievement. There have been several successful programs, such as UTeach (see **The UTeach Institute** case study), used across the country to provide strong STEM focused pedagogy in addition to targeted recruitment of STEM majors as teachers for the K-12 system. With an increasing population of STEM majors and

a corresponding decrease in education majors across the region’s higher education institutions, the GLBR is more than ready for this type of program. Once new programs have been integrated into colleges of education, the GLBR should begin recruiting math teachers for the 5th -8th grades, with a specific focus on math majors. By recruiting and hiring STEM majors as teachers in the education system, the GLRB can improve the quality of the STEM teaching pool and mitigate a declining trend.

**Recommendation 2:** Increase K-12 STEM-aligned programming that

STRaTEGy in aCTion: PRojECT LEaD ThE Way

Project Lead The Way (PLTW) is a national provider of k-12 STEM programs. PLTW provides a curriculum and high-quality teacher professional development model, combined with an engaged network of educators and corporate and community partners to help students develop the skills necessary to succeed in a global economy.

is research-based with evidence of increasing interest in science

The implementation of Common Core is expected to have a positive impact on students’ acquisition of the skills needed for STEM careers. But there are additional ways in which the curriculum can be further augmented to support the development of STEM core competencies and increase interest in science.

STRaTEGy in aCTion: ChanGE ThE EquaTion

Change the Equation (CTEq) works at the intersection of business and education to ensure that all students are STEM literate by collaborating with schools, communities, and states to adopt and implement excellent STEM policies and programs.

CTEq’s corporate members are deeply committed to ensuring more-rigorous STEM learning for all Prek-12 students. STEM literacy opens doors to employment in every industry, sector, and profession, not just in traditional STEM fields—from entry-level jobs that require a certificate or associate degree to jobs in the C-Suite.

*Strategies*

**Strategy A:** Implement evidence-based programs for K-12 that show increase in STEM interest, especially in science

STEM careers require students who have an understanding of science concepts along with the ability to apply scientific reasoning to solve problems. The region’s science achievement must improve significantly if it is going to create the talent pipeline needed to meet future demand. As part of the STEM Study, the research team identified a set of evidence-based science programs from Change the Equation (see **Change the Equation** case study) that the GLBR can use to provide students with programs proven to have increased interest in science. Science programs that are already in place should be assessed against the same set of criteria used by Change the Equation to determine if they should continue in their current form or be modified. By using the same programs in similar educational settings, the region’s school districts can leverage lessons learned across schools, funders can target their funding, and programming can be better tied to results.

**Strategy B:** Scale project-based learning methodologies for STEM learning

Teachers overwhelmingly agreed that project- based learning is an effective teaching method for STEM skills. However, fewer than half of the schools surveyed use project-based learning in their classrooms. Project-based learning is not appropriate for every subject, but should be utilized for STEM-related courses. GLBR school districts

should either create their own project- based programs or leverage programs that are currently available. If schools choose to create their own project-based learning opportunities, criteria outlined by leading organizations for project-based learning strategies should be used in the design of the programs34. There are also evidence- based programs, like Project Lead the Way (see **Project Lead the Way** case study) that can be implemented. By incorporating project-based learning into the curriculum, students are able to build such 21st century skills as problem solving, team building, communications and leadership.

**Strategy C:** Leverage STEM Subject Matter Experts to supplement curriculum and add workplace experience into classrooms with continuity across all grades

There is no shortage of STEM Subject Matter Experts (SME) in the GLBR, from the scientists at Dow Chemical to the welders at Merrill Technologies, to the Cardiac Unit nurses

at McLaren. These STEM practitioners can help bring STEM careers to life and provide students with real-world applications of what they are learning in class. In all grade levels, exposure to STEM careers must be consistent, connected and augment the curriculum. Critical to the success of this strategy is the need for a streamlined recruiting, training and matching process that will make this an easy and fun experience for both teachers and STEM SMEs. Demonstrating “STEM in action” through the use of SMEs in the classrooms allows students to see the everyday application of STEM subjects, and also highlights the various jobs and careers available across STEM fields.

**Recommendation 3:** Increase the number of out-of-classroom experiential STEM learning opportunities

Interest in STEM is increased when children have multiple opportunities to engage in STEM-related experiences outside of their classrooms. After-school clubs, summer camps, internships and other experiential learning opportunities have proven to be effective in strengthening and supporting students’ interest in STEM. To increase student interest in and development of STEM skills, experiential learning opportunities should be expanded.

*Strategies*

**Strategy A:** Increase the availability of evidence-based, out-of-classroom STEM experiential learning opportunities for K-12

Across the GLBR, there are many STEM- related programs targeted at the K-12 population. Very few, however, can show evidence of program effectiveness in terms of students’ interest in STEM or improvement in math and science comprehension. As part of the STEM Study, the research team identified a set of evidence-based, out-of- school programs from Change the Equation that the GLBR can use to provide students with proven programs that have led to an increase in STEM interest. Out-of-school programs that are currently in operation should be assessed against the same set of criteria used by Change the Equation to determine if they should continue in their current form or be modified. By using evidence-based programs, civic organizations,

funders and parents can be assured that what they are delivering is achieving the intended outcomes.

**Strategy B:** Target and scale evidence- based programs for girls and minorities

The GLBR must increase the pool of candidates for its STEM talent pipeline if it is going to remain competitive in a global economy, and getting both girls and low socio-economic students more involved in STEM programming and careers presents an opportunity to do so. By 8th grade, girls are, on average, on par or slightly above boys in both math and science proficiency. However, there is a sharp downward trend in girls’ pursuit of higher levels of STEM-related classes and participation in STEM-related activities outside of school after 8th grade. Additionally, students from low socio-economic backgrounds perform 25 percent lower than their peers and find it harder to access after-school programming because of barriers such as the cost of programs and lack of affordable transportation options. A critical resource that could help the GLBR remove some of these barriers is the list of evidence-based, out-of-school programs recommended by Change the Equation. This list includes specific programs proven to be effective in enhancing STEM interest in both girls and low socio-economic populations. School districts should identify the programs that best fit with and address their school population needs. Additionally, the GLBR should focus resources on providing subsidized fees for programs and to cover the cost of transportation.





REqUIREMENT: PoWEREd By CaREER aNd CoLLEGE REady STUdENTS 27

# Requirement: focused on Strengthening Technical Skills needed for the Economy

#### “We’ve hired from multiple training programs in the area and still need to train for up to two years internally.”- Employer in Manufacturing

Businesses in the GLBR employ a significant number of highly skilled STEM workers, with the strongest demand for skilled trades, technicians and healthcare workers. Many of these STEM workers are trained through technical education programs that are currently struggling to meet employer needs and expectations. Given employers’ needs for such workers, developing an effective technical education system will be critical to the long-term success of the GLBR.

Technical skill training providers offer different entry points for different types of individual: high school students, workers seeking to continue their education, or incumbent workers. A range of providers delivers technical skill training within the GLBR, including K-12 Career and Technical Education (CTE) programs, community colleges (non-credit and degree/certificate programs), private training providers and four-year universities.

foCuSED on STREnGThEninG TEChniCaL SkiLLS nEEDED foR ThE EConoMy

kEy finDinGS:

1. The quantity of highly skilled technical workers coming from technical skill training programs is not sufficient to meet current and future demand.
2. Inadequate access to CTE programs is one of the main causes of this gap.
3. dated mindsets around technical skill-based careers persist among community stakeholders.
4. There is limited use of Workkeys or other credentials to certify readiness for technical (or STEM) careers.
5. Up-skilling and retraining working-age adults could potentially address workforce needs.

A high-performing STEM region is one in which technical skill training providers offer training that is aligned with employer requirements and that provides students with opportunities to learn STEM skills in advance of employment. Students have the opportunity to participate in experiential learning opportunities that build skills, and training provides the student with an understanding of what life would be like in a particular career. Employers and training providers develop strategic partnerships to align curricula, streamline recruiting and develop workers in advance of employment.

28 BuiLDinG a RoBuST STEM TaLEnT PiPELinE in ThE GREaT LakES Bay REGion

#### “Schools often struggle to find funds to send students, but districts are also not great about advertising their legal responsibility to provide transportation.” - Regional CTE Provider

###### Finding #1: The quantity of highly skilled technical workers coming from technical skill training programs is not sufficient to meet current and future demand

Based on the employer survey, the majority of employers (approximately 60 percent) indicated that the STEM jobs they find hardest to fill only require a high school diploma/GED or two-year degree35. Over the past 24 months, there have been over 5,134 open STEM job postings that require less than a bachelor’s degree36. This indicates an unmet demand for skilled technical workers in the GLBR that is projected to increase over the next 10 years. Across Michigan, production jobs alone are expected to grow by six percent37.

A shortage of supply is intensifying competition for this segment of the workforce. Across Michigan, there has been a 15 percent drop in high school CTE enrollment for STEM- related fields—a decline largely driven by declining interest in construction tracks38. Two additional factors restrict the ability of the STEM talent pool to keep pace with expected demand growth. First, CTE and other STEM programs are not enrolling significant numbers of female students. Indeed, there are more than seven men for every female participant in these programs39. Second, an aging workforce is going to start retiring in the near future. About 54 percent of Michigan’s skilled trades workers are over 45, and 19 percent are over 55.40 If no action is taken to increase the supply of highly skilled technical workers, GLBR employers will be even more challenged to remain competitive.

###### Finding #2: inadequate access to CTE programs is one of the main causes of this gap

Access to educational opportunities is one of the primary drivers in determining the number of students enrolled in a particular program. Some GLBR students and their parents face challenges accessing quality CTE programs, and for three main reasons: financial barriers for schools and students; workforce development incentive structures; and the relevance of programs to employer needs.

###### Finding 2a: financial incentives discourage school districts; inability to obtain or transfer credits discourages students

The current incentive structure does not encourage schools to send K-12 students to CTE programs. Michigan law requires school districts to transfer 50 percent of their pupil allocation if one of their students attends a CTE program, but the district is still required to maintain support services (e.g. counseling, athletics, etc.) for that student. Schools must provide additional transportation to help students get from their home school to CTE programs, but often do not receive additional funding to do so. The upshot: students who are unable to travel to programs do not go.

Articulation agreements allow students to receive credit for classes taken at one school towards graduation requirements at another. Agreements may exist between high schools and colleges or among colleges. However, not all high school CTE programs have existing or strong

articulation agreements, and this can hinder students from pursing a STEM career path. While many local schools have articulation agreements in place, only three of the state’s 40+ CTE programs have master agreements that allow credits to be accepted at all public universities and community colleges across the state.

Individual school districts and local colleges are responsible for coordinating articulation agreements. If high school CTE programs do not have the funding to support these types of agreements, they are unable to provide credits for their CTE classes. When CTE programs are unable to provide any credit towards a college or high school degree, students are essentially left to pursue the program as an extracurricular. The lack of credits creates disincentives for students who would need to make both an additional educationaltimecommitmentandafinancial one to enter a CTE track.

###### Finding 2b: Workforce development agencies are

not incentivized to direct clients toward technical training tracks

The training programs to which workforce agencies typically send clients are geared toward filling immediate or near-term demand, rather than delivering the intensive training or credentialing programs that are often critical pathways to STEM careers. Agencies are measured by how quickly and effectively they can match clients with open positions. As a result, they are less likely to send clients to intensive technical training programs, even though such programs might result in higher-wage, higher-demand STEM positions.

#### “Clients often come to us as a last resort; the shorter the program, the more likely the client will be successful in finding a job…” – Workforce development agency

“often the effectiveness of a particular educator is driven by participation of his/her advi- sory board” – Representative from State office of CTE

###### Finding 2c: It’s difficult to attract instructors, and business participation is needed to keep programs relevant

GLBR businesses do not consistently engage with technical programs to help shape curricula. While advisory boards exist for most CTE programs, their effectiveness is often driven by the participation of the members. Boards are required to have representation from business and other industry experts, but need only meet biannually and are often not fully engaged in curricula development processes.

Technical skills providers also struggle to attract experienced and effective instructors. Programs face both educational and financial barriers to accessing qualified talent. High school CTE instructors are required to have a Bachelor’s degree, even for career tracks that might not require a four-year degree (e.g., production and construction). Programs exist that allow instructors to pursue a bachelor’s degree while teaching, but potential instructors must be motivated to earn the addition credential. This requirement effectively reduces the pool of potential instructors significantly. In addition, compensation is low relative to opportunities within industry, so many potential instructors choose to stay within industry.

###### Finding #3: Dated mindsets around technical skill based careers persist among community stakeholders

Parents can have a critical influence on their children’s educational pathways. If parents do not have a positive view of a particular program, they are less likely to support a child’s participation in that program. During interviews with educators, businesses, workforce development agencies and economic development corporations, many interviewees mentioned the widespread belief among parents that a four-year degree is the only path to success. Furthermore, many parents perceive careers in manufacturing, including skilled trades, to be “dirty” and encourage kids to pursue four-year degrees, even if the child is a good fit for skilled trades careers.

#### “around here, when people hear skilled trades, they think of the time when people worked on a factory line. Parents today don’t want their kids doing that kind of work – having “dirty fingers” – but today’s manufacturing isn’t like that. It’s all about technology. It’s changed a lot.” – Manufacturing Employer

###### Finding #4: There is limited use of Workkeys or other credentials to certify readiness for technical (or STEM) careers

The ACT WorkKeys assessment helps ensure that individuals are ready for work by helping students understand the skills they currently possess as well as the skill levels required for the careers they are considering. The WorkKeys assessment is given to nearly every Michigan student enrolled in 11th grade. However, educators do not use WorkKeys scores to evaluate career readiness. Moreover, most employers in the region do not require WorkKeys scores from job applicants or even consider them part of the evaluation process; nor have they benchmarked their positional needs

against scores. WorkKeys is proven to have a higher correlation to an individual’s success in a position than a job tryout, passing an interview, or possession of the right education, training and experience.

ACT also has a program, the ACT WorkReady Community Program, which uses its National Career Readiness Certificate (NCRC) to help communities measure and close the skills gap. By using the WorkReady Community Program, counties can measure employers’ needs and workers’ skills consistently, assess the skills gap in a timely manner, and offer educational pathways and credentials to close the gap. However, none of the five counties in the GLBR is utilizing this program.

###### Finding #5: up-skilling and retraining working-age adults could potentially address workforce needs

The GLBR has an opportunity to retrain the current workforce. Nearly 74.6 percent of the working-age population in the GLBR is aged 25 – 64, while only 25 percent is aged 15 – 24. The higher availability of workers aged 25-64 represents a more immediate pool of talent to reskill than does the more gradual flow of young graduates. Skills alignment and associated training programs for unemployed and incumbent workers offer the chance to build a highly skilled workforce that does not consist entirely of new graduates42.

By ensuring that pathways into post- secondary training are made available to all workers (rather than just K-12 students), a much broader section of the population can be leveraged to fill unmet needs.

###### focused on Cultivating Technical Skills needed in the Economy: Recommendations

The Driven by Employer Demand and Focused on Cultivating Technical Skills Needed in the Economy recommendations are closely intertwined. The outputs, the quantity and specific types of employer skill needs act as a critical input for providers to build student skills through programming adjustments and experiential learning opportunities. Research and interviews with GLBR stake- holders revealed two primary issues with technical skill training. First, technical skill providers have been unable to base programming on employer needs because they have limited visibility into employer demand requirements. Second, students do not have regular access to work-based learning opportunities that develop their STEM skills in advance of full employment.

Education, training and workforce providers must align around employer requirements and provide students with opportunities to develop STEM skills before they begin their careers. When training providers and employers are committed to developing talent that meets employer needs, workers are better prepared for entry into the workforce, employers face reduced training costs, and individuals are more likely to pursue educational opportunities that offer strong employment prospects.

STRaTEGy in aCTion: CoMMon LanGuaGE PRojECT

Texas Workforce Commission Common Language Project – Detailed Work activities: the common language project provides both business and education with a common language to define work and associated learning expectations. The Common Language Project’s online tool allows training providers to assess curricula against employer needs by comparing course language and descriptions with employer job profiles and requirements. This enables secondary and postsecondary partners to align the curriculum and develop course materials that are more relevant and responsive to employers’ needs.

**Recommendation 1:** Align programming and curricula with employer requirements

Aligning training provider curricula and programming with employer requirements is a critical step to developing the right technical skills for the GLBR economy. Training providers should not spend time teaching future workers skills and competencies that employers do not require. Right now, GLBR training providers have varying levels of alignment with employer requirements. There is no perfect training solution that will meet the needs of all employers, but the GLBR should strive to develop a system that best meets the foundational needs of employers. When training providers are closely aligned with employer requirements, employers can spend less on training new employees and their new hires will become fully productive employees much faster.

*Strategies*

**Strategy A:** Engage training providers to evaluate structure of curricula/programs

Employers and business associations should engage training providers to evaluate the structure of their curricula and programs. Training providers can start by identifying whether their curricula are defined in terms of skills and competencies, what types of evaluations are used to track student progress, and whether employers are engaged in programming refinement. Performing this baseline evaluation will allow training

providers to participate more effectively in discussions with employers about job requirements and educational programming.

**Strategy B:** Convene training providers to evaluate curricula against employer skill requirements, identify gaps, and refine curricula

Training providers should be routinely convened to assess and refine curricula in response to employer needs. Training providers should use job postings and discussions with employers to assess whether programming and curricula fit employer needs. Such analysis can help training providers identify gaps and areas of need quickly. Assessment and refinement should occur on a regular basis and progress towards addressing critical gaps should be measured. Language-based tools, like that developed by the Texas Workforce Commission (see **Texas Workforce Commission Common Language Project** case study), can accelerate this process by compiling language from employer job descriptions and educator course materials.

**Strategy C:** Communicate the expected skills and competencies for graduates of regional training programs

Once training providers have conducted their analysis of curricula and programming against employer requirements, they should communicate to employers the skills graduates will have upon graduation of the

programs. Many employers do not have a detailed understanding of the skills for which training providers are preparing students. This formal exercise will help employers understand the areas where training providers are focused, as well as those areas on which employers should focus. Communication may take place through regular data-sharing agreements, quarterly meetings, etc. When training providers clearly articulate the specific skills and competencies that they are training for, employers are better able to develop in-house training or identify supplemental providers to address skill gaps.

**Strategy D:** Utilize assessments and credentials to measure job-seeker skills against technical requirements on an ongoing basis

Employers can use assessments and credentials for a variety of purposes, including evaluating competency levels, comparing candidates and evaluating training providers. Employers and training providers must agree on which assessments will be used and what performance on these assessments indicates. If training providers are using certain assessments to certify student achievement or progress, but employers do not acknowledge that achievement, then such assessments become less valuable. Employers and training providers should agree upon the skills and competencies that are important to evaluate and identify which assessments have been proven to measure those competencies. Once employers and training providers begin utilizing common performance assessments, employers can have confidence in graduates’ abilities and students can earn credentials that certify their skill set to employers.

STRaTEGy in aCTion: GRanD RaPiDS aDvanCED ManufaCTuRinG TRaininG PRoGRaM

The Grand Rapids advanced Manufacturing Training Program is a regional example of an effective training provider/employer relationship. The program is a new, innovative apprenticeship program developed to meet the needs of local manufacturers, and designed to train advanced manufacturing workers using the German model of dual education of high school students based on combining apprenticeships and vocational education. In the Grand Rapids program, students work apprenticeships four days per week and attend classes at a local community college on the fifth day. To avoid large class sizes and balance work schedules, classes are held daily with rotating groups of students.

**Strategy E:** Build standardized feedback mechanism for continuous improvement of programming

In the current system, most training providers lack a mechanism to gather feedback from employers regarding the strengths and weaknesses of their graduates. Training providers have limited information about program effectiveness beyond job placement rates, which do not provide any actionable information. Employers and training providers in the GLBR should develop a standardized feedback mechanism that enables employers to provide confidential and anonymous information about program strengths and weaknesses. Establishing formal feedback programs allows training providers to adjust programming based upon employer feed- back and encourages employers to expend more effort in understanding what makes an effective employee.

**Recommendation 2:** Scale STEM experiential learning opportunities

Experiential learning opportunities offer students a way to learn a variety of workplace and occupation-specific skills in a real-world setting. Work-based learning programs such as internships, apprenticeships and co-ops improve skill retention and give students better clarity about career fit. In addition, these opportunities offer employers a chance to evaluate potential job candidates in a risk-free environment. While many experiential learning programs exist within the GLBR,

it should expand offerings in high priority skill areas. Expansion of experiential learning programs can greatly enhance the quality of upcoming graduates, reduce employer time-to-fill for open positions, and reduce employers’ retraining costs.

*Strategies*

**Strategy A:** Obtain commitments from employers who are willing to offer experiential learning opportunities

The GLBR should engage employers with high demand for priority skill sets and obtain their commitment to develop or scale existing experiential learning programs. This will build a strong foundation to grow and develop experiential learning programs. The Grand Rapids Advanced Manufacturing Training Program is one example of a strong, effective training provider and employer experiential learning partnership (see **Grand Rapids Advanced Manufacturing Training Program** case study).

**Strategy B:** Increase job shadowing, internships, apprenticeships and co-ops for high school, two-year and four-year students

Additional experiential learning opportunities will offer a greater number of interested students the chance to experience STEM careers firsthand, and to develop STEM skills. Employers in the GLBR offer recurring experiential learning opportunities in many forms, including two-year apprenticeship

programs or summer internship programs. These programs should be continued and expanded, both with employers who already offer opportunities as well as for those who do not currently offer these opportunities but have demonstrated willingness to do so in the future. Increasing the number of work-based experiences available to students will provide students with exposure to STEM careers before they have to commit to additional education or training.

STRaTEGy in aCTion:

The Cristo Rey network Work Study Program operates as an employee leasing agent, in which the students are employees of the Work Study Program, not the corporate client. In addition, the Work Study Program handles all payroll, W-4, I-9, Workers’ Compensation, fICa, fUTa and other employer issues for the students. The fee charged to the company is deducted as a business expense, not a donation.

**Strategy C:** Develop a universal, streamlined process and application to facilitate easier onboarding for employers and students

A standardized process and application should be developed to facilitate a better onboarding process for students participating in experiential learning programs. Employers often find navigating the consent, tax and payroll process burdensome and may avoid the hassle by turning down the opportunity to have a student worker. Developing a streamlined and standardized process for employers—as was done by the Cristo Rey Network (see **Cristo Rey Network Work Study Program** case study)— can expedite the onboarding process and eliminate barriers to offering these opportunities in the first place. Equipped with a standardized process, training providers can manage and respond better to employers who are offering experiential learning opportunities and remove some of the process burden they currently endure.

**Strategy D:** Develop externships for educators to refine STEM career knowledge

Teachers are in the best position to prepare studentsforfurtherlearningandSTEMcareers. Often, the quality and relevance of a student’s education is dependent on the capability of the student’s instructor. If teachers cannot demonstrate and communicate the value of a skill effectively, the quality of a student’s education may suffer. The GLBR should work to identify those teachers who would benefit from externships and those employers who have the capacity to develop an effective learning program for teachers. Teacher externships, especially those in the STEM fields, have proven highly effective at improving teaching competencies and offer an alternative to traditional summer employment for teachers. The IOWA Math+Science Partnership (see **Iowa Math+Science Partnership** case study) provides an example of how to structure a process that matches willing employers with teachers.

STRaTEGy in aCTion: ioWa MaTh+SCiEnCE EDuCaTion PaRTnERShiP

The ioWa Math+Science Education Partnership facilitates real world externships for teachers of math, science, and technology. The program provides educators with an experience that allows them to inform students about STEM fields by working side-by-side with knowledgeable and skilled employees at local businesses.

Externships are paid and provide a valuable alternative to other teacher employment options during summer breaks.



34 BuiLDinG a RoBuST STEM TaLEnT PiPELinE in ThE GREaT LakES Bay REGion

# Requirement: Sustained by a Culture of STEM

#### “The Great Lakes Bay Region needs to support and encourage STEM programs and baseline science and math skills for our students. a region known for this expertise in industry can’t maintain long-term success counting on outside support.” – Saginaw County Parent

Establishing STEM as the engine for growth in the GLBR requires a cultural shift within the GLBR community. The community must promote the need for high levels of numeracy in the same manner that it supports literacy. This requires a shift away from the old view that skilled trades jobs are not a viable career option and towards a new mindset that says these careers can provide workers with a high quality of life. It also requires a shift in the way funders support STEM, with an increased focus on funding programs that can prove they are successful in achieving the community’s STEM goals.

###### Finding #1: There is not a common definition of STEM within the GLBR

35

SuSTainED By a CuLTuRE of STEM kEy finDinGS:

1. There is not a common definition of STEM within the GLBR.
2. “Random acts of STEM” are not aligned with a common agenda or supported by metrics to evaluate effectiveness.
3. GLBR parents are interested in STEM, but not always aware of STEM program opportunities.
4. Students have limited exposure to and understanding of different STEM occupations.
5. Parents feel that a lack of interest is the primary barrier to students’ engagement in STEM-related activities.
6. Businesses are generally willing to help increase STEM awareness.
7. Females perform on par or better than males in core STEM competencies, but are underrepresented in STEM careers in the region.

Interview participants from all stakeholder groups did not have a common understanding of what STEM meant within the region. Some stakeholder groups talked about STEM in terms of specific content areas. Others spoke about STEM in terms of different occupations. Still others felt that it was simply the latest “catch phrase” and didn’t really have any specific meaning. This has caused confusion within the community. There is no basis for classifying activities as “STEM-related” and no common language stakeholders can use to describe the issues relevant to them. As part of the STEM Study, a STEM definition was created and should be used moving forward (**see Appendix for STEM definition**). The STEM definition

REqUIREMENT: SUSTaINEd By a CULTURE of STEM

#### “More awareness and education are needed ... or a common use of language is needed.”

- Isabella County Middle School Teacher

is occupation- and industry-based, which eliminates subjectivity in determining who counts as a “STEM worker” and allows training programs to be better classified. A common definition of STEM will help clarify the meaning of STEM for the region, and this in turn will help drive alignment of skills and competencies, curricula and programming.

###### Finding #2: “Random acts of STEM” are not aligned with a common agenda or supported by metrics to evaluate effectiveness

More than 70 STEM programs were documented across the region. This included a mix of nationally recognized STEM programs (e.g. Girl Scouts – STEM for Girls, Junior Achievement – STEM Connections, FIRST Robotics) and local STEM programs (e.g. Bay Sail and Camp Invention). Across the wide variety of STEM programs, most did not track evidence of impact. Although the volume of programs indicates the region’s support for STEM, these “random acts of STEM” actually limits the region’s ability to deliver a unified, impactful STEM agenda.

###### Finding #3: GLBR parents are interested in STEM, but not always aware of STEM program opportunities

Parents see STEM education as very important for their children. About 89 percent of surveyed parents perceived STEM education to be important to their children’s development, and 87 percent wanted to see more STEM opportunities in the classroom. Most parents reported difficulties in identifying such opportunities. Asubsetofparentsdiscovered STEM-related opportunities through their children’s teachers, school newsletters and Internet searches; however, this was the result of proactive action to identify opportunities versus programs that were generally known across the community. This disparity between the relative abundance of STEM opportunities and poor awareness among parents means that available programming is underutilized.

#### “There are no hard and fast metrics or measurement used for outcomes right now, mostly general ideas around wanting to raise awareness and make STEM fun/cool.” – Corporate foundation Executive



“The school does not clearly communicate the opportunities to parents. This is a huge barrier as parents cannot encourage participation if they don’t know about events.”

- Saginaw County Parent

###### Finding #4: Students have limited exposure to and understanding of different STEM occupations

Frequent and sustained exposure to STEM careers can boost students’ interest in and pursuit of STEM educational and career paths. However, students in the region are rarely exposed to STEM careers in their classrooms. About 90 percent of teachers reported that their students have fewer than six opportunities to be exposed to STEM jobs annually. In addition, 62 percent of principals indicated that there were no STEM elective courses offered at their school. Among those students already familiar with the term, many associate it with a small subset of STEM-related occupations (e.g.

FIGURE 11

Students Selecting a Profession in STEM (n-82)

engineering and science) and exclude other occupations that are dominant in the region (e.g. healthcare and skilled trades) (see Figure 11). These findings indicate a gap both in STEM skills’ importance to the region’s

Engineer Computer Science

FIGURE 12

62

Engineering & Science

52

Healthcare & Skilled Trades

30

26

25

25

Carpenter Accountant Nurse Welder

employers and in the types of jobs that are considered to be STEM.

###### Finding #5: Parents feel that a lack of interest is the primary barrier to students’ engagement in STEM-related activities

Parents perceive three primary barriers to their children becoming interested in STEM:

* Child Interest

### Parent Survey of Barriers to STEM Involvement

* Financial Barriers
* Program Distance

More than 22 percent of parents indicated the primary barrier is related to a lack of student interest (see Figure 12). If schools can increase exposure to STEM occupations in school, and communicate opportunities to parents better, then student interest in STEM could be substantially improved.

**0% 5% 10%**

**22%**

**20%**

**11%**

STEM programs are located too far away

I cannot afford to send my child to STEM programs

My child is not interested

**15% 20% 25%**

About 20 percent of parents surveyed cited financial constraints related to STEM programs. If the community can improve subsidies for STEM programming, or low- er the cost, the financial barrier can be substantially reduced.

###### Finding #6: Businesses are generally willing to help increase STEM awareness

Finding #7: females perform on par with males in core STEM competencies, but are under- represented in STEM careers in the region

Females constitute more than half of the GLBR population, yet they are significantly underrepresented in the STEM workforce. Using the GLBR definition of STEM occupations, females are underrepresented

FIGURE 13

GLBR Participation Rate in STEM

1.4

1.23

0.78

1.2

Some businesses are already contributing

many different resources to support STEM in the region and nearly all indicated a willingness to offer additional resources in support of STEM education. In interviews, businesses suggested several forms of potential assistance including:

* Financial support
* Technology / tools
* Employee time
* Job shadowing
* In-class demonstrations
* Job site walkthroughs
* Awareness videos
* Participation in career day events

Businesses, however, take different approaches. Some take a proactive role to engage with educators, while others wait for educators’ guidance on how they can best lend support. Providing clear ways for businesses to participate will allow them to choose where they can best contribute.

in STEM careers by 22 percentage points (see Figure 13). According to MEAP scores, females in the region are as academically qualified to pursue STEM education and careers as their male counterparts, indicating a healthy supply of potential talent by middle school. However, as females progress along their academic paths, they encounter barriers that push them towards non-STEM post-secondary educational and career tracks.

###### Sustained by a Culture of STEM: Recommendations

A strong STEM culture ties together the other three requirements to create a strong STEM talent pipeline. Some individuals and organizations are doing great work within the GLBR, but those efforts could be connected and coordinated better. The strong appetite for STEM among the community has no unifying theme and many are unaware of concurrent activities. Building a strong STEM culture will create the conditions in which people can continue to do great work, but in a more focused and outcomes-oriented fashion. With better coordination and collaboration, educators can improve the delivery of STEM education, businesses can communicate STEM needs better, and training providers will be better able to develop STEM skills. What’s more, more students will be interested in STEM subjects and pursue STEM careers.

1

0.8

0.6

0.4

0.2

0

Male Female

1 =

proportional to population

**Recommendation 1:** Change perceptions and increase interest in STEM

Perceptions of STEM differ throughout the GLBR, depending on which industry is at issue. When people think about STEM in terms of engineering and healthcare, the perceptions are positive. There are, however, negative reactions when they think about STEM in terms of skilled trades or manu- facturing. When parents, teachers and peers discuss STEM in a negative light, it can have a direct impact on a student’s interest in the field. Building a robust STEM talent pipeline requires a community that embraces the value of STEM across all industries and supports student interests across different STEM occupations.

*Strategies*

**Strategy A:** Launch targeted marketing campaigns supported by regional STEM spokesperson(s) and a website/portal to increase STEM awareness

An effective STEM marketing campaign should focus on the STEM occupations that have the highest current and future demand, based on employer needs. The marketing campaign should be tailored to address the needs and concerns of each target population (students, parents, teachers, employers, underrepresented populations). Putting a “face” on the STEM effort is critical. Individuals readily recognized as leaders in the region, who are respected within the community, and are perceived to be trust- worthy should champion the marketing campaign, which should be designed to improve collective understanding of the value of STEM to the region as a whole and to stakeholders individually. The community should know where they can go to find information about STEM opportunities, get engaged in the STEM Impact Initiative, and contribute information to the website.

**Strategy B:** Develop materials to educate guidance and career counselors on STEM opportunities, resources, and tools (e.g. online career pathways)

Guidance counselors are among the most critical stakeholders when it comes to influencing student and jobseeker awareness and interest. Their direct contact with every student in a high school puts them in a unique position to effect change. Training materials on STEM careers, opportunities, resources and tools need to be developed and distributed to guidance counselors in high schools, colleges and workforce agencies. Guidance counselors who are empowered to provide STEM career information to students can have a significant impact in a short period of time.

**Strategy C:** Develop and execute recurring student, parent and teacher surveys to measure interest in and awareness of STEM

GLBR parents, teachers and students have varying degrees of awareness of and interest in STEM. Understanding the change in awareness of these individuals can help the region track progress of the overall effort to change the GLBR culture. These three critical stakeholder groups should be regularly surveyed to measure current STEM interest and awareness. Survey results can be valuable to marketing efforts and can inform alternative strategies for increasing awareness of and interest in STEM.

**Strategy D:** Develop requirements and identify host for region-specific career exploration tools

Careerexplorationtoolscanhelpindividuals identify their professional ambitions and the best educational paths to achieve those ambitions. National resources provide helpful resources and content, but an online exploration tool customized to the GLBR should be developed to assist students and job seekers. Such a tool will allow students

to find educational and career resources in their area and communicate the unique needs of the GLBR more effectively. The tool should provide students and job seekers with a range of information including: the skills required for a given position; the educational options available to obtain those skills; links to local educational programs; and representative compensation information. Stakeholders will need to work together to design and develop the tool (e.g. industries included, target audience, technology platform, etc.) as well as to identify the proper organization to host the tool.

**Strategy E:** Engage students in championing STEM in the region

Students can be the best ambassadors for STEM in the region. Students should be engaged in the STEM Impact Initiative and given opportunities to showcase why they perceive STEM to be “cool.” These opportunities can come in the form of competitions, such as the “Northwest Michigan Education Advisory Group’s Student Video Challenge,” where students are asked to create videos showing why a specific STEM field is “cool” (e.g. manufacturing); the opportunity to act as one of the regional spokespersons; or through video testimonials, which can be showcased online, as to why STEM is important.

**Recommendation 2:** Eliminate barriers and incentivize students and job seekers to pursue STEM careers

A variety of both barriers and incentives are in place across the education and training provider landscape, many of which hinder the development of the GLBR STEM talent pipeline. Some of these barriers, such as technology, can be addressed with focused attention. But the GLBR should also look to refine its incentive structure through the use of scholarships and credit articulation agreements. Alignment of incentives with desired behavior will drive student interest and enrollment in STEM programs.

*Strategies*

**Strategy A:** Support expansion of STEM scholarships by identifying areas of highest need and identifying funders

to fill those needs

One of the primary barriers preventing students from pursuing STEM degrees is the associated expense. Remediation classes are particularly challenging, as they are rarely credit bearing and add time and money to the cost of the degree. Scholarships can help ease the financial burden— especially given the high probability that students will require some form of remediation in college. There are pockets of STEM scholarships across the GLBR, but few are aligned to in-demand skill areas or promoted effectively to students. The number of scholarships should be increased, targeted to in-demand occupations and proactively advertised to students. More scholarships will reduce the financial burden on students who are interested in but cannot afford to pursue a STEM degree.

**Strategy B:** Convene educators to:

* Increase credit value and expand the number of articulation agreements between CTE, two-year and four-year universities

Most schools and post-secondary programs have articulation agreements that allow students to earn and transfer credits between one another, but the credit values that are transferrable vary substantially. Schools should work to increase and standardize their articulation agreements within the region, which can help make degrees more affordable for students and reduce time to completion. Additionally, high schools should expand the use of programs such as Advanced Placement (AP) and the International Baccalaureate (IB), which are accepted already at most post-secondary institutions.

* Develop a plan to embed industry- recognized credentials into curricula

Once training providers and employers have agreed upon accepted and recognized assessments or credentials per the Driven by Demand recommendations, they need a strategy for incorporating these assessments and credentials into the GLBR’s training provider programming. This will enable students to graduate with the right job credentials without having to pursue pre-employment credentials after graduation. It will also allow employers to identify qualified candidates before program completion and reduce unemployment time for graduates.

* Examine national models for STEM early college

Early college high schools blend high school and college, compressing the time it takes to complete a high school diploma and the first two years of college. The schools are designed to help high school students earn a high school diploma and an associate degree or up to two years of credit toward a bachelor’s degree—tuition free. Early college programs have proven to be very effective in filling in-demand STEM jobs, especially in the skilled trades. They have also been effective in increasing the number of low-income and first-generation college participants. The GLBR should do additional research into those specific models to determine whether they would address specific demand gaps or if they improve outcomes for target populations.

* Address availability/access to technology in schools

Technology skills are required for nearly every job. There are widely varying ratios of students to available technology (i.e. laptops, tablets, computer labs, etc.) across the region’s schools. School districts must bridge these gaps and ensure all students have access to the technology they will use in their careers. Educators should conduct a survey of classrooms across the region to identify areas of weakness and then develop an action plan/fundraising strategy to address gaps.



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# Taking action

#### The STEM Impact Initiative is a long-term, community-driven process that is going to require stakeholders from across the region to work together. The STEM Study has outlined the recommendations and strategies needed to create a strong STEM talent pipeline. The difficult task of putting these strategies into action lies ahead. To support this work, the STEM Impact Initiative established a set of guiding principles for the community. These principles will guide the STEM Impact Initiative implementation effort.

**Mobilization:** (November 2014 – February 2015)

The Mobilization Phase is focused on getting the proper infrastructure in place to support the STEM Impact Initiative activities. This includes establishing a program management office (PMO) organization and securing the leaders who will be involved in executing the recommendations.

**Launch:** (March 2015 – December 2015)

The Launch Phase is focused on short-term activities that will allow GLBR to “jump start” the overall initiative. This will include

Phased approach

The STEM Impact Initiative will require contributions from multiple stakeholder groups – business, K-12 education, higher education, nonprofit organizations, work- force development, economic develop- ment and funders. The work has some interdependent areas and some that are stand-alone. GLBR will take a phased ap- proach to implementation:

**Research:** (May-October 2014)

The Research Phase focused on establishing the current state of the GLBR STEM system and identifying recommendations and key activities to support the region’s implementation of a STEM talent pipeline. In October 2014, the research phase came to a close with the completion of the STEM Study.

specific pilot opportunities to test solutions with a particular community or institution(s) before scaling those opportunities during the implementation phase.

**Implement:** (January 2016 and beyond)

The Implementation Phase is focused on long-term activities, using the lessons learned from the Launch Phase. This phase will scale efforts that showed impact in the Launch Phase and will add activities that will impact the entire community.

FIGURE 14

• C-suite level stakeholders across pertinent stakeholder groups (i.e. CEOs,

Superintendents, Executive Directors, etc.)

• Manager level stakeholders with connection to the specific rowing area (i.e. Education, Business, Marketing, etc.)

• Full-time or part-time staff dedicated to supporting specific areas

• Oversight and accountability

• Sets strategy and policies

• Measures performance against strategies

• Aligns actions to strategies

• Implements strategies

• Measures progress towards outcomes

• Provides back office support

• Execute communications

• Conduct fundraising

Key Responsibilities

Key Stakeholders

Program Management Organization

Delivering Organization

Steering Organization

###### organizational infrastructure

To build and sustain the GLBR STEM talent pipeline, the GLBR will need to establish a strong regional infrastructure. In order to ensure clear direction, action and outcomes, it is critical to have three organizational components in place: a steering organization, a delivering organization, and a program management organization.

Each of these three components will be needed in order for the STEM Impact Initiative to be successful. The following infrastructure support model will be established: a GLBR STEM Steering Team as the steering organization; two STEM Networks as the delivering organizations; and a program management office (PMO) housed within the GLBRA. The GLBR Steering Team will consist of key stakeholders across the region including employers, K-12 administrators, teachers, parents, economic and workforce development agencies. The GLBR Steering Team will be responsible for oversight of the networks. It will also be accountable to the community on progress towards the collective STEM goals.

The STEM Networks are volunteer-led collaborative groups responsible for the implementation of the strategies for each STEM Talent Pipeline requirement. These groups consist of key stakeholders from specific areas of influence (i.e. STEM employers, training providers, K-12, civic organizations) whose engagement and participation are critical to successful strategy implementation. The two STEM Networks will focus on Jobs & Skills and Students & Culture. The STEM Networks will have the power to convene, organize, plan, and solicit funding to support their respective activities. The GLBRA will take responsibility for establishing the PMO and for the advocacy activities.

FIGURE 15

Jobs & Skills STEM Network Students & Culture STEM Network

Great Lakes Bay Region STEM Steering Team

##### Chair Team Members

Project/ Initiative Lead

Chair Team Members

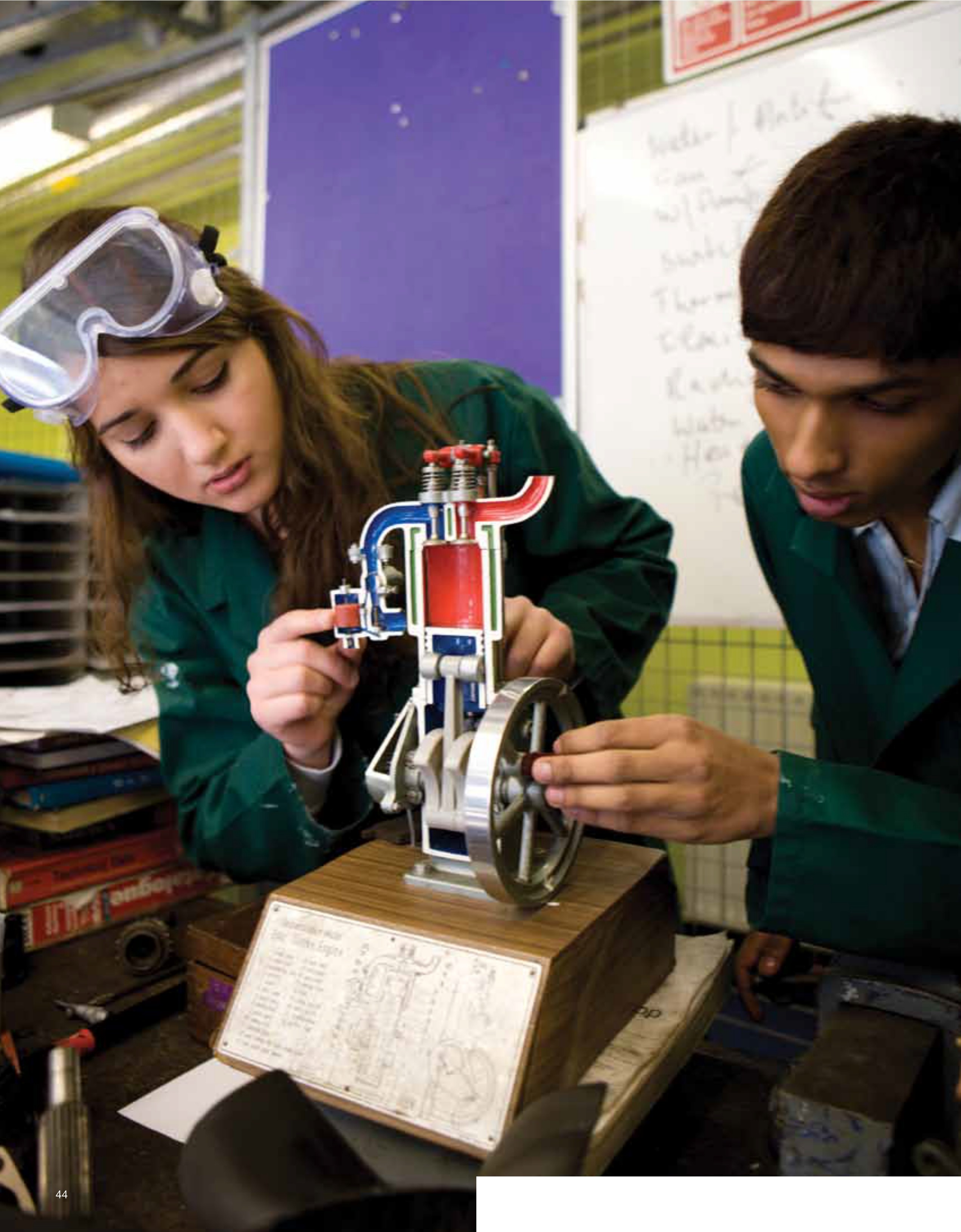
Project/ Initiative Lead



STEM Program Manager Investor Relations Lead Advocacy Lead

Grant Lead Communications Lead

Advocacy and Program Management Office



BUILDING A ROBUST STEM TALENT PIPELINE IN THE GREAT LAKES BAY REGION

# Call to action

#### The GLBR is poised to become a leading STEM region for the country and we are off to a great start. The completion of the research phase has given us the data and analysis we needed to understand our starting point. We found a strong STEM infrastructure with our leading STEM industries and pockets of collaboration, partnership and programs across the region that touched on different aspects of the talent pipeline. We found strong teacher professional development at Bay City Public School’s Great Expectations Professional development Program and equally strong CTE programs at Bay-arenac Career and Technical Education. our students are participating in such STEM activities as the FIRST Robotics team at Bullock Creek and the Science Under Sail program run by Bay Sail. our region’s higher education institutions are working closely with our local STEM employers to meet STEM demands through the Rapid Response Training Programs in Welding, Manufacturing/Plastics and CNC operation at Mid Michigan Community College, as well as through the accelerated Computer Numerical Control (CNC) Program at delta College. our colleges and universities are working to promote STEM majors. Case in point: alma College’s Positive Routes into Science and Mathematics (PRISM) Project. Furthermore our Great Lakes Bay Manufacturing Association produced critical information for job seekers through the development of career ladders for manufacturing jobs in the GLBR.

* STEM employers collaborate with education partners to create the work- force for the future with the right skills and competencies.
* STEM employees help educate children about STEM jobs while also accessing STEM opportunities for their own children.
* Educators have the support and resources to teach, inspire and turn out students who are excited about STEM and are academically strong in STEM subjects.
* Civic and corporate funders support initiatives that align with the community’s STEM goals and show evidence of success.
* Students are excited about and proactively seek out opportunities to expand their STEM knowledge.

All in all, the region becomes an integrated and interconnected system that produces high-quality talent and drives the region’s economy.

The STEM Impact Initiative is a tremendous opportunity for the GLBR to become a national model for the creation of a fully integrated STEM talent pipeline. Across the country, states and regions are working on pieces of the talent pipeline puzzle, but no one region has yet put all of the pieces together. If it gets this right, the region can become a premier location for STEM businesses, a recognized source of STEM talent across the nation and globally, and a leader in STEM education for the country.

###### Get Engaged in the STEM

We’ve developed a roadmap to help guide our actions so that they are targeted and impactful. We have also used the past five months to build momentum and buy- in across the region with our community leaders and key stakeholders. We learned about best practices from others across the region and around the country, which gives

us a clear set of requirements for building a robust STEM talent pipeline. These requirements have become our guideposts to align our time, money and people. This community effort requires each person to understand the role they play in building a strong STEM talent pipeline:

###### impact initiative

Every member of the community has some- thing meaningful to contribute and we want to leverage all of that passion, talent and commitment to make this initiative a success. If you are interested in getting involved in this effort, please visit the GLBRA website at [**www.greatlakesbay.com**](http://www.greatlakesbay.com/) to learn how you can get involved.

# appendix

###### dEFInITIon oF STEM FoR ThE GLBR

The STEM definition for the Great Lakes Bay Region is occupation driven. The region’s tailored list of SOC (Standard Occupation Classification) codes consists of five job categories:

* + Analysts/Accounting positions are defined as occupations that focus on mathematics, data analysis, and accounting.
  + Engineering/Skilled Trade positions include traditional engineering occupations such as Civil Engineers, Mechanical Engineers, Engineering Technicians, and Drafters, in addition to those Skilled Trade occupations with intensive STEM training requirements, such as CNC Machinists, Electricians, and Plumbers.
  + Healthcare positions include the full range of clinical care occupations.
  + IT positions include all Information Technology jobs that support functions in application and website development, database administration, networking and support, and management.
  + The Sciences category includes roles in hard sciences, such as biology (including non- clinical medical research), chemistry and physics.

**An occupation-driven STEM definition uses STEM occupations as the basis of under- standing what makes a STEM industry – and ultimately what STEM means to the region.**

* + A STEM Industry has a high concentration of STEM jobs, drives economic prosperity, and promotes innovation. STEM Industry links with the Talent Pipeline to align education and training with demand-driven and market-relevant skills.
  + A STEM job requires application of knowledge across the areas of science, technology, engineering, and/or mathematics, and demands higher-order critical thinking and problem-solving skills. A STEM Job:
    - Requires a post-secondary degree, industry certification/ licensure, and/or advanced training
    - Links to career pathways with increased earning potential
    - Provides opportunities for advancement and continuous learning in STEM and non- STEM fields

ConTaCT uS

if you would like to learn more about the STEM impact initiative, please send an email to [**STEM@greatlakesbay.org**](mailto:STEM@greatlakesbay.org)

## EnD noTES

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