# MiSTEM Advisory Council

Report #2

December 15, 2016

# Introduction

This is the second report issued by the MiSTEM council. The first report was issued in 2016 and was completed in about 45 days after the council was fully assembled. This second report had a little over seven months to reconsider the work assembled and look deeper into key issues. Michigan has the necessary components to be the **world leader in STEM as a result of our strong talent, educational institutions and industry.** Michigan's labor supply is strong with 16.7% of all degree completers in STEM, which is slightly higher than the national average of 14.2%. (DTMB, Bureau of Labor Market Information and Strategic Initiatives). Michigan is home to some of the finest higher education institutions in the world, including some of the largest public research universities in the nation. And since 2010, STEM employment opportunities have continued to grow and have outpaced overall occupational growth in the state. STEM job opportunities are expected to grow by 11.8% through 2020 compared with 8.5% for all occupations. More than 75% of U.S. automotive research and development occurs in Michigan. Our largest metro area, Detroit, is ranked 3rd in the U.S. as a prime source for technology jobs[1] and is still in the top ten metro areas for patent applications--a standard in measuring innovation. (US Patent and Trade Office, 2013). However, these components are disconnected and our edge may be slipping as a result.

There is tremendous demand for greater emphasis on STEM from business and education across the state. Michigan businesses are struggling to find talented employees. Indeed, there are nearly 100,000 open positions on mitalent.org that employers struggle to fill. Our dedicated teachers are searching for better ways to teach STEM to engage their students. And most importantly, all of our students need to see how STEM education is a powerful tool for navigating the dynamic and complex world they live in.

The MiSTEM Advisory Council consists of business, higher education, K-12 education, and philanthropic leaders and was created by the Michigan Legislature to help make Michigan a world leader in STEM education.

What the Council has found is that Michigan is full of "random acts of STEM". These uncoordinated efforts are proof of pent up demand for a better way to do STEM in Michigan. This report represents a first step in creating a statewide direction for STEM.

We must recognize what makes Michigan great and seize on the opportunity that Michigan represents. Michigan was once the center of the world for technology and pioneered the nation's, if not the world's, environmental protection policies. The MiSTEM Advisory Council believes that Michigan can again create the talent that

[1] Crain's Article - Oregon economist says Detroit is hotbed of tech jobs (2015)

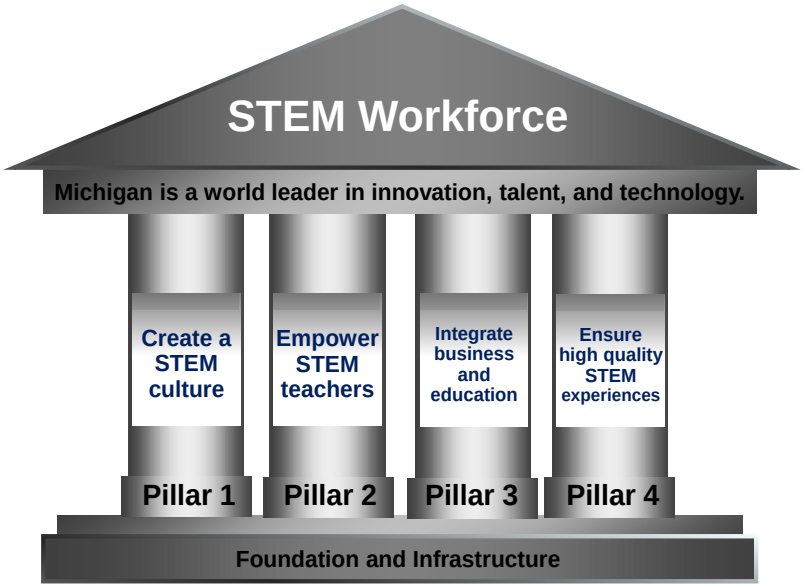
leads the world in the development of 21st century mobility technology and addresses the world's climate, energy, and resource challenges.

There are important changes in STEM in Michigan this year and next including changes to No Child Left Behind (NCLB) Act to the Every Student Succeeds Act (ESSA) changes how federal funds flow into the state and impact operations of the current Michigan Math and Science Centers to provide professional development for teachers. Also, Career Technical Education or Skilled Trades work was mostly directed to others to focus on. This team still considers these STEM jobs as part of the overall STEM plan. There are some key, new recommendations called out this year to that end.

# A Vision for STEM in Michigan

The MiSTEM Advisory Council envisions that every K-12 student in Michigan has access and exposure to outstanding STEM programs in order to become STEM equipped. In order to do this, there must exist a cohesive approach to STEM in the State. The Council confirmed the need and priorities of the following four pillars to this approach:

1. Michigan must create a robust culture of STEM.
2. The educator pipeline must be strengthened.
3. Business and educators must be integrated.
4. Michigan must ensure quality STEM experiences.




Much like the new Michigan Science Standards, these pillars feature crosscutting concepts. For example, the teacher pipeline must be filled with quality professional development, preferably in partnership with local businesses, in order to drive a culture of STEM education in the classroom to increase student proficiency with the Michigan Science and Mathematics Standards.

In addition to these four pillars, the Council recognized that there is some infrastructure that exists to support STEM and that infrastructure is called out with some recommendations in this second report.

## Pillar 1: Create a STEM Culture

The National Academy of Engineering has identified fourteen grand challenges that the next generation will need to address if we are to advance our quality of life[2]. Many of these problems cut across energy, health, sustainability, security, and even learning itself. Addressing these national and global challenges requires a workforce equipped with advanced STEM-based skills and talents, and at one time, Michigan was at the center of solving these problems. Talents of the likes of Walter Chrysler, Herbert Dow, Thomas Edison, Henry Ford, Daniel Gerber, W.K. Kellogg and William Upjohn have called the Wolverine state home. If Michiganders pull the existing pieces together, we can once again be the world's center for innovation and technology.

Although institutions of higher education in Michigan are already recognized worldwide for their STEM degree programs, industry is still starved for talent and additional growth in numbers can be realized only if pipeline issues are addressed. Industry is dependent on access to talent for its growth and institutions of learning need to be engaged in nurturing those talents to create the next generation scholars, designers, and innovators. Each of these sectors has to commit to a STEM culture and vision in order for Michigan to again be the world center of innovation.

It is an innate human desire to want to innovate to create a better future. STEM is an answer to that desire. Whether you work with your hands or your mind, whether you're the architect or the foreman, STEM engages students at an intrinsic level. In fact, STEM is better thought of as a mindset than a set of careers. It is a mental toolbox that allows for a collaborative approach to tomorrow's novel problems. It is students being able to cultivate intellectual fearlessness and curiosity. It is treating failure as enrichment. These tenets cut across all topics, from art to construction, from design to soldering.

This allows STEM to truly unlock the potential hidden in Michigan's students by creating students who think creatively and remain engaged in their learning. This mental toolbox can be applied to whatever interests a student, including fields like graphic and video game design, where students are able to express themselves with current or future real-world, employable skills. Artists today use 3D printers, electronic textiles tablets, and digital animation just as much as they use paint, clay, and paper. All students, no matter their field of interest, can benefit from a hands-on, interest-driven learning process.

[2]National Academy of Engineering - Grand Challenges for Engineering

STEM also can provide focus and hope to struggling and disadvantaged communities as both a way to keep students engaged in school and as an economic development mechanism. STEM is a bridge that will allow communities to celebrate a more diverse set of student talents and interests. Some schools focus on the athletic aspect in creating individual students, and similarly STEM highlights academic success and hands on experiences that students bring to the community. By celebrating these types of students, communities will be able to embrace the culture that these individuals have set in place, allowing for a culture of STEM to create a rallying point and ray of hope for struggling communities. STEM can help young talent become involved in their neighborhoods and participate in their revitalization in a meaningful way.

Perhaps the highest hope of parents is to see their children go into a successful career. In Michigan there is no better path to a high paying job through the acquisition of STEM skills. From 2010 to 2013, employment in STEM occupations in Michigan grew by 12.8%, compared to only 2.1% for all occupations. Further, STEM jobs earn 60% more on average; Michigan's average wage in 2013 was $21.40 an hour, compared to STEM occupations that earned $34.40 an hour[3]. Fields once thought of as dirty, grimy, and unsafe are now the opposite. Today's factories have replaced soot with clean rooms, heavy tools with precision robots, and dirt with immaculate factory floors. Of course, STEM is not only present in manufacturing. One need only to hear hospital advertisings bragging about robotic surgery departments to see proof of how STEM is fueling the meteoric rise of the healthcare industry. Parents, students, and teachers need to be exposed to the careers of the 21st century.

Embracing a robust, extensive and inclusive STEM culture as part of Michigan's DNA is imperative to inspire, inform and bring along our whole community toward economic and educational success. STEM culture is important if we are to inspire our youth to develop a passion and understanding for STEM education and career pathways. We should strive to have our students and their families understand what it means to have follow a STEM pathway and the steps that lead to a successful STEM career including fueling their desire to seek STEM experiences both inside and outside of school, and to help all students feel that STEM is accessible and feel prepared to continue on to high education and/or a career in STEM.

**New 2016 Recommendation #1:**

***Support a state funded, coordinated campaign to build STEM awareness, and communicate needs and opportunities for all stakeholders.***

- Stakeholders: students, parents, educators, and the business community
- Develop and implement a multi-level communication campaign (similar to the Pure Michigan Campaign) with specific messaging for teachers,

[3] A Look at STEM Talent in Michigan

businesses, parents & students. Establish and fund a central website, owned by the Council, for the state wide MiSTEM initiative.

- Partner with Michigan businesses to showcase talent needs that connect to specific STEM career opportunities.
- Develop a strong brand for STEM by modeling the campaign after the successfully branded Pure Michigan campaign (e.g. Pure MiSTEM).
- Support the campaign with large STEM events that integrate business/industry with teacher training and parent training. Examples include fun and innovative hands-on programs such as CUE with STEAMpunk playgrounds and Rock Star jam sessions[4].
- Get parent involvement in STEM utilizing practical applications with the students
- Support the campaign with regional/grass roots events that provide a visual awareness of STEM (e.g. MiSTEM booths at local career fairs or parent nights).
- Promote the Michigan Department of Education's Top 10 in 10[5] Strategy 2.6 c: Develop a P-12 system wherein every student in Michigan is able to engage in integrated STEM and STEAM programming, with certification for STEAM competencies to be included on their high school diploma/transcript.

## Pillar 2: Empower STEM Teachers

The adoption of the new Michigan Science Standards represents a new era of teaching in Michigan. The strength of the new Michigan Science Standards is that they integrate content knowledge with the practices used in real world careers to make use of this content knowledge. While the standards represent the separate disciplines of earth and space science, life science, and physical science in the core ideas, these disciplines are united through concepts that cut across all science disciplines. These cross cutting concepts such as patterns, cause and effect, scale, systems, energy, structure and function, and stability and change, all address important interdisciplinary themes.

In addition, science educators are encouraged to integrate science and engineering (as engineering, technology and applications of science) with mathematics and technology, promoting a true "STEM" focus for instruction in our state. And most importantly, the standards are no longer represented as static expressions of facts, but instead use dynamic performance expectations to ensure that students learn how to integrate meaningful content in problem solving experiences through experiential and applied learning of real-world practices. The focus on the *application* of content is an important attribute that characterizes a STEM focus for instruction in that the new standards provide a framework for integrating important

[4] CUE Conference Website
[5] Michigan Department of Education Website

content into real life problem solving settings that support both academic and career preparation[6].

According to a recent National Academy of Science Study on Science teacher preparation[7], there are many factors that contribute to a potential disparity between the vision afforded by the new Michigan Science Standards and the realities for how teachers will implement them.

> *"At the elementary level, science is not taught much. With double periods of mathematics and language arts, there simply is not room in the school day for teaching science. At the middle and elementary school levels, teachers are underprepared to teach deep content and to focus on core ideas—they may not understand these ideas themselves. In high school, teachers too often are 'siloed' in their own classrooms and certainly in their own departments—an arrangement that again is antithetical to the notion of core ideas and of one learning experience serving as the basis for the next." (NAS, 2015 pp. 63-64).*

To ensure that our state will have educators who can support the implementation of integrated STEM instruction we need to have educators who are skilled at teaching using STEM integration that focuses on content knowledge and addresses problem-solving skills and inquiry-based instruction using technology and computational thinking to address meaningful real life problems. Unfortunately, *"… available evidence suggests that many science teachers have not had sufficiently rich experiences with the content relevant to the science courses they currently teach, let alone a substantially redesigned science curriculum… Within the current science teacher workforce, preparation in science, whether through a disciplinary major or coursework, is especially weak among elementary teachers and not strong among middle school teachers" (NAS, 2015 p. 87).*

> *"It is critical, however, to resist the temptation to blame teachers for the current state of science teaching practices, which reflect the varied and under-conceptualized support teachers receive from schools and districts. In addition to being prepared as generalists, elementary teachers have very limited time to plan and deliver science instruction, while teachers at all levels receive little time, structure, and support for their own learning, whether through traditional professional workshops or through teacher study groups or one-on-one coaching. Finally, resources for science are limited, and many teachers,*

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[6]Wang, H. H., Moore, T. J., Roehrig, G. H., & Park, M. S. (2011). STEM integration: Teacher perceptions and practice. Journal of Pre-College Engineering Education Research (J-PEER), 1(2), 2.

[7]National Academies of Sciences, Engineering, and Medicine. (2015). Science Teachers Learning: Enhancing Opportunities, Creating Supportive Contexts. Committee on Strengthening Science Education through a Teacher Learning Continuum. Board on Science Education and Teacher Advisory Council, Division of Behavioral and Social Science and Education. Washington, DC: The National Academies Press.

*especially at the elementary level, view the available equipment, supplies, facilities, and instructional technology as inadequate" (NAS, 2015 p. 66).*

Teachers want to teach this way, but many are not sure how to best make this happen. Further, the Council has found that many teachers do not know what opportunities exist in the state. As stated earlier, Michigan already has the pieces necessary to create world-class STEM experiences. All teachers should have an easy-to-access place to support them in the classroom, discover resources, and network with STEM organizations and other STEM teachers. This would allow teachers to access externships, professional development opportunities, STEM projects, philanthropic funding, and any other resource in their region or the state.

**New 2016 Recommendation #2:**

***Empower STEM teachers by integrating new ESSA law changes into the state plan and offering incentives for STEM teachers to remain in the education system.***

- Ensure the new state plan that incorporates the ESSA law changes continues to focus on teacher training (including the STEM Master Teacher Corps).
- Ensure the new state ESSA plan allows for more flexibility in STEM teacher certification (e.g. flexibility in placement of teachers in the classroom).
- Examine alternative paths for teacher certification in STEM.
- Implement models that ensure focused STEM teachers in elementary (e.g. Team Teaching models).
- Offer incentives (e.g. differential pay) to encourage math/science teachers to remain in teaching positions as opposed to pursuing other higher paying opportunities outside the educational system.
- Provide hands-on practical applications (props/tools) integrated into STEM teaching.
- Encourage more business and teacher engagement. Experiential engagement like internships or job shadowing is preferred. Will require creativity for funding with ideas like tax incentives for companies.
- Engage Michigan universities receiving state funds to participate in STEM developed teacher recruitment, training, and retention.

## Pillar 3: Integrate Business and Education

Too frequently educators lament the lack of business interest in education while at the same time business leaders search for ways to get involved. **It's time to create a formal mechanism to connect Michigan's education and business sectors.** This will not only help connect students to future employment, it will also expose teachers to real world methods and practices that they can then bring back to the classroom and help businesses better understand how educators can assist in creating the talent they need. And like with the new Michigan Science Standards, businesses aren't just looking for content experts. They are also looking for

teamwork, leadership, and a mental toolbox that can cut across content areas to solve tomorrow's problems.

Logically, this should be done on a regional level using frameworks that already exist in the state. With a regional focus, students will get more relevant experiences, businesses will see a clearer talent pipeline, educators will have easier access to employers, and regional needs can be addressed with regional strengths.

Every teacher (and probably parent) has heard a student ask the question, "How will I ever used this in my life?" This is a real concern that students rightly have regarding their education. If what they are learning is not relevant to them they will not be intrinsically motivated to learn. But if the content in the classroom can be tied to relevant local needs and/or employment opportunities that they see every day, for instance to windmills in Mid-Michigan, students will connect with their academic career in a deeper way. **Students need their education to be relevant to them**, and creating regional STEM connections is one way to do that.

Today's economy moves very quickly and businesses cannot wait in order to remain competitive. this has resulted in many STEM opportunities in the state existing at the high school level is because it's a quicker return on talent investment for businesses. However, in regions with mature partnerships, businesses are quickly realizing that **high school is simply too late to get students interested in STEM.** Many educators, with business partners who recognize the value in starting early, are beginning to reach into middle and elementary schools to begin cultivating student interest in STEM.

Many of the "random acts of STEM" seen in the state are happy accidents that resulted from coincidental relationships between educators and businesses. These regional partnerships have been successful for a variety of practical and logistical reasons, not the least of which is that it allows for educators to have easy access to employers that are relevant to students and their associated talent needs. This allows for teachers to customize instruction based on the needs of employers and for students to see a clear pathway to future employment through that instruction.

All of the pieces for regional integration already exist, including data, a regional framework, and networks. Michigan's Labor Market Information office already publishes regional employment forecasts and some regions have done more in-depth research into future employment needs. Several regional frameworks, including the state's Regional Prosperity Initiatives, are already up and running, and the Math Science Centers provides a network of STEM-focused staff.

The example and priority of business and education integration through STEM can offer a model for finding solutions and more understanding about other challenges in Michigan education. When schools and businesses collaborate, our students will achieve more.

**New 2016 Recommendation #3:**

***Implement a proven, outcome based model for regional collaboration that integrates all STEM stakeholders (business and education).***

- Form collaborations with all business and educational stakeholders including the Michigan Chamber of Commerce, Michigan Economic Development Corporation, Michigan Department of Education, and Business Leaders for Michigan, higher Education, Business, and K-12 school systems, etc.
- Research and identify a best practice to serve as a model for further development (e.g. Talent 2025, Great Lakes Bay Regional Alliance, etc.).
- New STEM centers (previous Math & Science Centers) to lead efforts if there isn't one already within their region in alignment with their developed regional STEM plans.

## Pillar 4: Ensure High Quality STEM Experiences

Every teacher wants to deliver high-quality instruction. Due to a variety of reasons, it's difficult for teachers to know what STEM programs are high quality. Many in the state struggle with this same challenge, and the Council will begin laying the groundwork to answer this question. Starting this year, the Council will begin examining criteria for high-quality STEM experiences for students. However, we all agree that high-quality programs:

- are hands-on, problem-based, authentic, engaging and experiential;
- are aligned to the Michigan Science and Mathematics Standards;
- go beyond content knowledge and teach life skills like communication; teamwork, leadership, critical thinking, and gracious professionalism;
- utilize industry partners;
- create value for educators, students, and businesses; and
- provide an atmosphere for students to express themselves and have fun applying STEM skills and interests to creatively solve personally relevant problems.

The Council would recommend the state seek a set of metrics to monitor progress and success, including but not limited to:

Grades 4 math and science proficiency, Grade 8 math and science proficiency, adoption of STEM education and career paths, STEM education graduate rates, and apprenticeships and internships. Metrics should be both quantitative and qualitative and align with the state's new culture of STEM. That is measuring beyond test scores alone to include numeracy, literacy and scientific knowledge, and project-based learning indicators and measurements.

The Council would recommend the state seek a set of metrics to monitor progress and success, including, but not limited to:

- Grades 4 math and science proficiency
- Grade 8 math and science proficiency
- STEM education degree attainment
- Apprenticeship completion

Metrics should be both quantitative and qualitative and align with Council and State's new vision for STEM success in Michigan. That is, measuring beyond test scores alone but also numeracy, literacy and scientific knowledge and project-based learning indicators and measurements.

**New 2016 Recommendation #4:**

***Implement metrics to evaluate and recognize quality STEM programs[8].***

- Utilize the STEMworks[9] rubric to evaluate current STEM programs supported by the state and vet new programs as directed in the 2016 budget legislation.
- Track and communicate outcome data on current and approved programs (best practices) on a STEM dashboard.
- Provide PD resources for proven STEM programs.
- Consider STEM recognition (e.g. a STEM "seal", certification or ranking) for schools/teachers that have formed collaborative relationships that have advanced STEM in their area (e.g. they have collaborated to build a technical training center or acquired a piece of equipment via a partnership with a business, etc.).

The MiSTEM council in conjunction with the Michigan Department of Education has been trained by Change the Equation on the STEMworks rubric. Additional personnel have been trained and a plan is in process for both developing a network of STEMworks reviewers and for reviewing all programs which are funded through the state. A list of programs funded by MDE via recommendations of the council were approved by the STEMworks rubric and are listed in Appendix B.

# Foundation and Infrastructure

## Math Science Center Network (STEM Centers)

MCL 388.1699s requires that the Council "work with directors of mathematics and science centers…to connect educators with businesses, workforce developers, economic developers, community colleges, and universities." To that end, we recommend to the Michigan Legislature, Department of Education, and Governor, that the Math Science Centers become the engine that drives regional STEM integration.

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[8] See Appendix A for recommendations from last year around quality STEM programs

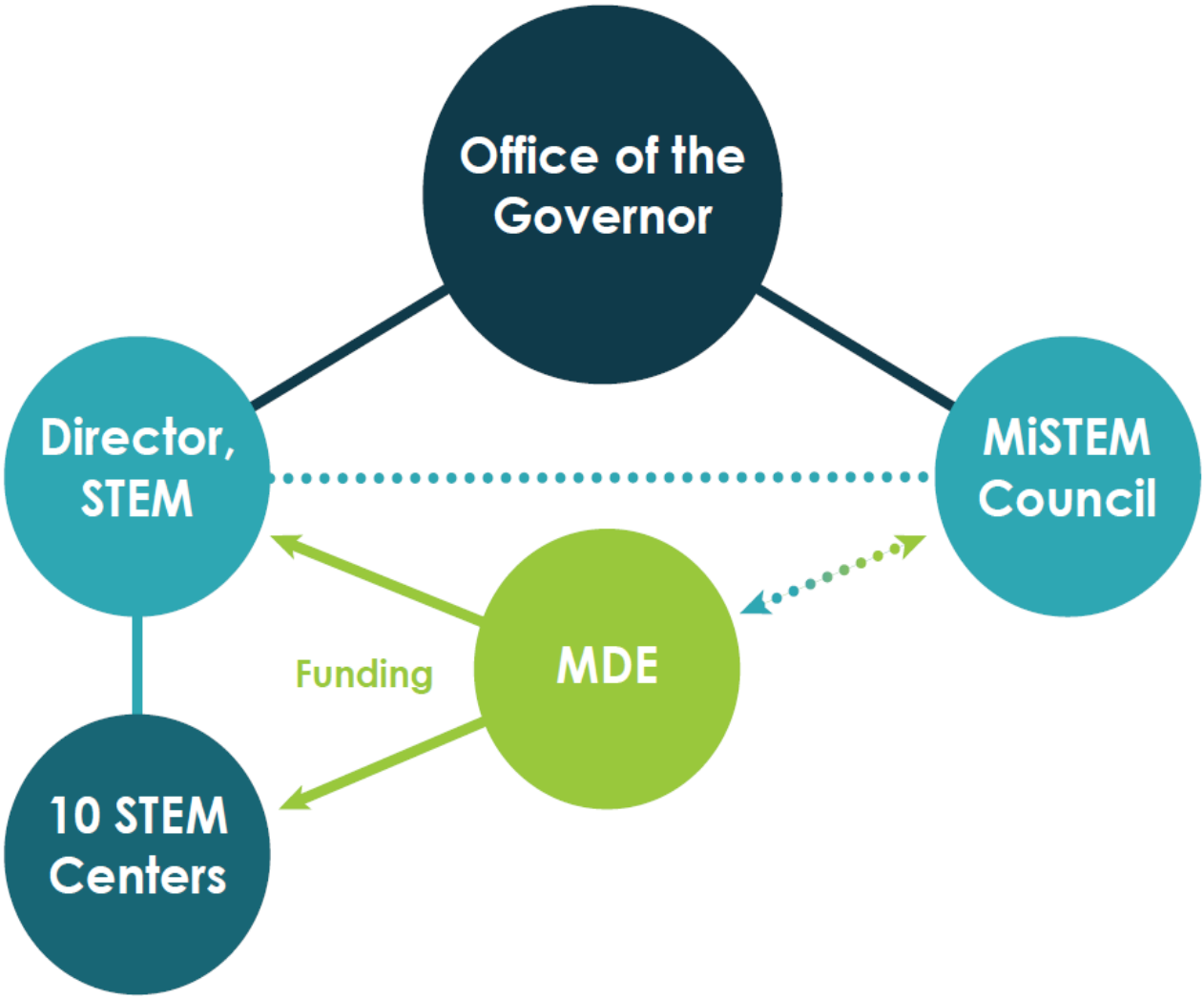
[9] Sec. 99s(2)(d) The MiSTEM advisory council shall recommend to the governor, the legislature, and the department a statewide strategy for delivering STEM education-related opportunities to pupils and objective criteria for determining preferred STEM programs. The MiSTEM advisory council shall use funds received under this subsection to purchase training for its members or their designees from the Change the Equation STEMworks rating system program for the purpose of rating STEM programs.

**New 2016 Recommendation #5:**

***Rebrand the Michigan Math & Science Centers as Michigan STEM Centers and align them regionally to the 10 Prosperity zones in Michigan.***

- Reduce the current number of Math & Science centers to ten.
- Fund the 10 STEM Centers at $200,000 each (2MM total) + $100,000 budgeted for an Executive Director separate from the 10 STEM Center leaders.
    - Ensure at least one full time person at each STEM center.
    - The Executive Director of the STEM centers would be the liason between the network, the state, Michigan Department of Education, and the MiSTEM council and would manage the website recommended elsewhere in this report as well as implementation of the STEMworks program. The council sees the position reporting in to the Governor's office for management. This Executive Director will need to lead the development of a new vision and master plan for the STEM centers.
    - We have a history with current Michigan Math & Science centers with success highly impacted from collaborative models. High collaboration includes a stronger higher education involvement or alignment. Recommend that these STEM centers be through a university/community college located within the Prosperity Zone. Ideal to cap or manage overhead costs for universities to a minimal amount. Universities would follow the recommendations outlined by MiSTEM and be networked back to MDE (alignment to MiSTEM strategy).
- Require all STEM Centers to facilitate the creation of a regional strategic plan for STEM education with local employers, educators, government organizations, students, and relevant community organizations.
- Empower STEM Centers to facilitate STEM events, such as educator/employer networking and STEM career and university recruitment fairs to raise STEM awareness.
- Allow STEM Centers to connect educators and employers to support a culture of intern/externships and apprenticeships for both teachers and students.
- Empower STEM Centers to bring together regional employers and educators to create guided pathways for regional STEM careers.
- Allow STEM Centers to contribute to the MiSTEM website, all stakeholders to network, access regional and state events, explore STEM careers, seek professional development and externship opportunities, and engage in other functions to further the mission of STEM in Michigan.

## STEM Centers Governance Model Recommendation



## CTE Equipment

Last year the Council was aware of a discussion regarding state funding for Career and Technical Education (CTE) equipment. The recommendation last year was that the state should direct funding for this equipment to activities that:

Must

1. be project-based;
2. be aligned to the regional strategic plan developed by the regional STEM Center;
3. have a business partner (or multiple partners) who agree, supported with relevant data, that the program will result in students acquiring skills that the employer will need in at least the next 5 years;
4. be able to lead to (but not necessarily result in) an industry-recognized credential, in technical skills that are of desired value in fields such as building trades, engineering, and entrepreneurship;
5. demonstrate a strong partnership between educators and employers through business donations of labor, teacher professional development, equipment maintenance and upkeep, or the equipment itself.

Ideally

1. integrate with a curriculum that increases proficiency with the relevant Michigan Science and Mathematics Standards;
2. result in an industry-recognized credential.

Further, the state should consider including maintenance and upkeep of equipment funded under this policy as an allowable use in future years. This could be a cost-effective way to keep high quality programs running. And finally, the Council would recommend that the state begin a discussion regarding CTE credentials and skills-assessment such that education and industry are in alignment.

The state allocated funds in 2016 for additional CTE development. Those funds and recommendations are being managed elsewhere. The council still believes that technical education is part of STEM and needs to be aligned with the bigger picture of total STEM developments within the state.

## Resourcing the Recommendations

New strategies often fail because of a lack of resources. The five new recommendations outlined prior in this report need to have resources to support their implementation. The MiSTEM council did not make formal budget recommendations in its first report outside of general guidance for the legislature to consider while making budget plans. For this second report after more experience and meeting with organizations directly funded from the state budget, the council elected to make some recommendations on STEM spending. The council considered the funds in sections 99(s), 99(t), & 99(h). Based on

current budget allocations, the Council makes the following budgetary recommendations.

## New 2016 Recommendation #6:

### *Change STEM funding based on current allocations*

- Align funded programs to STEMworks rubric.
    - Change funding from 1MM to 3.0MM (99s(2)(e) for funding MiSTEM approved programs (eliminate specific allocations for Olympiad and Van Andel and Online Algebra Tool), allowing more flexibility for school districts to apply for STEM program funds that better meet their needs.
- Funding of the new STEM (math/science centers): Allocate $200,000 each (2MM total) + $100,000 budgeted for an Executive Director.
- Opening of FIRST Robotics funding to other similar type programs.
- Other programs can be lower cost and offer access to more students while still providing similar learning and sill building experiences.

| *2017 Michigan State STEM Budget Recommendations from MiSTEM Council* | | |
|---|---|---|
| | **2016** | **2017** |
| **SECTION 99s** | | |
| MI STEM Council Admin (2) | 50,000 | 50,000 |
| STEM Council Grants (3) | 1,000,000 | |
| Math/Science Centers (4)* | 2,750,000 | 2,000,000 |
| STEM Center Executive Director | | 100,000 |
| Transition Funds** | | 500,000 |
| Science Olympiad (5) | 250,000 | - |
| Van Andel Institute (6) | 250,000 | - |
| STEMworks Approved Programs: | | 3,650,000 |
| Sec. 99s Total: | 4,300,000 | 6,300,000 |
| SECTION 99(t) | | |
| Algebra Nation | 1,500,000 | - |
| SECTION 99(h) | | |
| First Robotics | 2,500,000 | |
| First Robotics or Equivalents*** | | 2,000,000 |
| TOTAL Budget 99 s, t, & h: | **8,300,000** | **8,300,000** |
| * Rename Math & Science Centers to STEM | | |
| ** M&S Centers must complete implementation of final NCLB funds, plan new STEM org, & transition in 2017 | | |
| ***Vex, Square One, or ?? (Allow schools to choose and ensure equitable | | |

# Summary State Policy Recommendations

MCL 388.1699s further asks the Council to provide "recommendations designed to improve and promote innovation in STEM education and prepare students for careers in science, technology, engineering, and mathematics." The following are recommendations on state policy that will further the Council's vision for STEM in Michigan:

1. Support a state funded, coordinated campaign to build STEM awareness, and communicate needs and opportunities for all stakeholders.
2. Empower STEM teachers by integrating new ESSA law changes into the state plan and offering incentives for STEM teachers to remain in the education system.
3. Implement a proven, outcome based model for regional collaboration that integrates all STEM stakeholders (business and education).
4. Implement metrics to evaluate and recognize quality STEM programs.
5. Rebrand the Michigan Math & Science Centers as Michigan STEM Centers and align them regionally to the 10 Prosperity zones in Michigan.
6. Change STEM funding based on current allocations.

# Additional State Policy Recommendations

7. Senate Bills 169 and 170 (FY 2016) create the opportunity for students to receive a STEM endorsement on their high school diploma. The Council strongly supports the concept of recognizing students who have engaged in high quality STEM activities. We commit to partnering with the legislature to discuss, create, and implement a meaningful credential for students.
8. Senate Resolution 146 encourages Michigan communities to provide for incentives for young STEAM professionals. If communities or the legislature wish to pursue this, the regional framework recommended in this document may provide a possible avenue.

# Michigan MiSTEM Council

The MiSTEM Advisory Council was created in 2015 under MCL 388.1699s and is made up of 11 voting members serving at the pleasure of the Governor and 4 ex-officio legislators appointed from the House of Representatives and Senate.

Voting members:

- Co-Chair: Kathleen Bushnell Owsley, Executive Director, Bosch Community Fund
- Co-Chair: Christian Velasquez, Global Market Director, Dow Corning Corporation
- Harrison Ford, Kettering University Alumni (Graduated 2016)
- Lee Graham, Executive Director Operating Engineers 324 LMEC
- Jim Heath, Chief Operating Officer, Flexfab
- Kenneth Kelzer, Vice President Global Vehicle Components and Subsystems, General Motors
- Jay Kulbertis, Ed.D., Superintendent, Gladstone Area Schools
- Josh Nichols, STEM Teacher, Stockbridge Community Schools
- Satish Udpa, Ph.D., Executive Vice President, Michigan State University
- Carolyn Wierda, Executive Director of STEM@SVSU, Saginaw Valley State University

Legislative Appointees:

- Representative Leslie Love, 10th District (Detroit, Redford)
- Representative Jim Tedder, 43rd District (Waterford Township, Lake Angelus, Clarkston, Independence Township)
- Senator Hoon-Yung Hopgood, 6th District (Belleville, Romulus, Taylor, Westland)
- Senator John Proos, 21st District (Berrien, Cass, and St. Joseph Counties)

The Council would like to thank the Michigan Department of Education, particularly Ruth Anne Hodges, Megan Schrauben and Mary Head for the insight and support.

Appendix A

*The STEMworks rubric is in alignment with these recommendations from the original report.*

## State-Funded Activities

MCL 388.1699s further requires that the Council "make funding recommendations to the governor, legislature, and department for funding programs…" To that end, we have identified the following criteria by which all state-funded programs should be measured.

Any activity must:

1. be project-based;
2. demonstrably enhance proficiency in the Michigan Science and Mathematics Standards;
3. be aligned to the regional strategic plan developed by the regional STEM center;
4. have a business partner (or multiple partners) who agree, supported with relevant data, that the program will result in students acquiring skills that the employer will need in at least the next 5 years;
5. collect and report data to the state that can be used to examine individual student outcomes.

Further, activities will ideally:

1. be accessible to every student during normal school hours at no cost to the student;
2. contain a teamwork component that is applicable to in-class activities;
3. be able to be started in middle school or, more ideally, in elementary school;
4. be paired with a regional higher education and/or business supported professional development component that supports the integration of the Michigan Science Standards;
5. promote soft skills that enhance career and college readiness;
6. leverage state funds by demonstrating strong partnership with local businesses or philanthropy through donations of funds or other in-kind support.

Appendix B

2016-2017 Section 99s(2) and (3) - MiSTEM Advisory Council Grant

From the appropriation made under Section 99s(2) and (3) in the fiscal year 2016 State Aid Act, $1,000,000 has been appropriated to fund grants recommended by the MiSTEM advisory council for highly rated STEM programs in Michigan. The council will make specific recommendations by December 15 of each fiscal year for awards up to $250,000 each.

The table below lists the projects approved for funding. All these projects appear on the current STEMworks list of high-quality STEM education programs (STEMworks Homepage).

| Project | Amount | Project Contact |
|---|---|---|
| Engineering is Elementary (Elementary & Middle School) Engineering the Future (K - 12 ) | $250,000 | Greg Johnson<br>johnsog@resa.net<br>Wayne County Math and Science Center |
| INTEL Math (Washtenaw) | $250,000 | Andrea Pisani<br>apisani@washtenawisd.org<br>Livingston/Washtenaw Math and Science Center |
| INTEL Math (Sanilac) | $75,000 | Nick Miu<br>nmiu@sanilac.k12.mi.us<br>Sanilac County Math and Science Center |
| Project Lead the Way | $175,000 | Lory Thayer<br>thayer@sresd.org<br>Capital Area Science and Math Center |
| Statewide Modeling Program | $250,000 | Michael Gallagher<br>michael.gallagher@oakland.k12.mi.us<br>Oakland Schools Science, Math and Technology Center |

Appendix C

## March 1, 2016 MI STEM Council State Policy Recommendations

MCL 388.1699s (FY 2016) further asks the Council to provide "recommendations designed to improve and promote innovation in STEM education and prepare students for careers in science, technology, engineering, and mathematics." The following are recommendations on state policy that will further the Council's vision for STEM in Michigan:

1. Senate Bills 169 and 170 (FY 2016) create the opportunity for students to receive a STEM endorsement on their high school diploma. The Council strongly supports the concept of recognizing students who have engaged in high quality STEM activities. We commit to partnering with the legislature to discuss, create, and implement a meaningful credential for students.
2. Senate Resolution 146 (FY 2016) encourages Michigan communities to provide for incentives for young STEM professionals. If communities or the legislature wish to pursue this, the regional framework recommended in this document may provide a possible avenue.
3. Encourage educators to engage in STEM-related work experiences that support long-term engagement with real world practices. One way to do this is to allow for teacher "externships" with regional businesses to count for continuing education credits, professional development hours, or other relevant professional credentials.
4. Support educators with high-quality professional development to implement the new Michigan Science Standards that focuses on using science and engineering practices to engage students with learning disciplinary core ideas and crosscutting concepts.
5. Create a model whereby properly vetted and qualified STEM practitioners can participate in teaching, particularly in CTE fields. One possible method is a "teaching internship" or "teaching residency" model with a certified mentor teacher to be able to lead to a certification for the practitioner should they choose to pursue one.
6. Begin recording student participation in registered apprenticeships.
7. Provide educators with opportunities for practicing and receiving feedback using teaching that engages students with using technology and computational thinking to address meaningful real life problems.
8. Develop and implement meaningful assessment tools and practices that document STEM learning for college or career readiness.