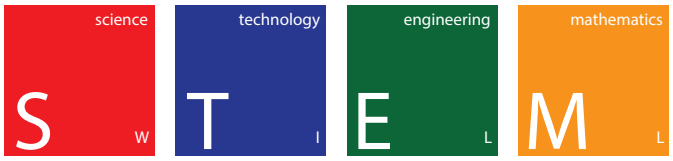
Wisconsin Institute for Law & Liberty

STEM Education: Beyond the Buzzword

a report from the Wisconsin Institute for Law & Liberty

Collin Roth
Research Fellow

September 2016



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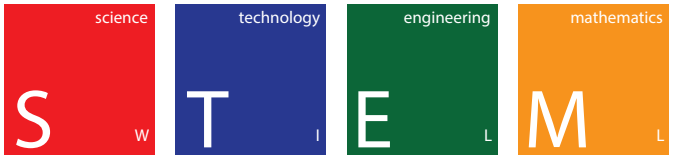

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I. INTRODUCTION

STEM education (science, technology, engineering, and math) is a frequently mentioned buzzword. But how is STEM taught in the classroom? How do schools interact with the community? And why are school districts embracing STEM?

By interviewing Wisconsin school leaders and members of the business community, we sought to answer these questions – and more.

Key Takeaways from STEM Report:

1. Businesses in Wisconsin complain about a "skills gap" problem.
2. STEM education is a good return on investment for schools, students, and business.
3. This report profiles two public schools that have utilized STEM in different ways.
4. Resources are available for schools looking to invest in STEM education.
5. While progress is slow, Wisconsin's continued focus on the skills gap and STEM education will pay off.

The Skills Gap: A Hurdle for the Badger State's Economy

The Great Recession hit Wisconsin particularly hard. Tens of thousands of manufacturing jobs evaporated in a matter of months, and the long slow grind of recovery saw Wisconsin finally reach pre-recession employment levels in the spring of 2015, more than six years after the stock market crash. But debates over the sluggish pace of job creation continued to color Wisconsin politics.

Despite enacting an aggressive pro-growth agenda of tax cuts, regulatory reform, and sound budgeting, the state's business community believes that Wisconsin's economy is being held back by a skills gap that leaves employers with open jobs that the workforce is unable to fill.

A July 2016 economic outlook survey[1] from Wisconsin Manufacturers and Commerce (WMC), the state's chamber of commerce, reported 70% of top executives expressing difficulty in finding qualified workers.[2] This is up from 53% just two years prior.[3]

"This is a harbinger of things to come unless business, government and academia can work together to both direct people seeking work toward in-demand careers and to attract more workers from outside Wisconsin to our state."

"Everyone who cares about our state's economy should be alarmed to learn that Wisconsin businesses are being forced to delay expansion projects, aren't bidding for contracts and are outsourcing work out-of-state because they can't find employees," said Kurt R. Bauer, President and CEO of WMC on the July 2016 economic outlook survey. "This is a harbinger of things to come unless business, government and academia can work together to both direct people seeking work toward in-demand careers and to attract more workers from outside Wisconsin to our state."

While employers are scrambling to address the present shortage, the skills gap has a very real human cost. Despite more than 90,000 job listings on the state's job center website[4], Wisconsin still has persistent and growing poverty. Even though recent economic growth that has more people employed than ever before, poverty in Wisconsin reached a 30 year high in February 2016.[5] Wisconsin's largest city and the economic engine of the state, Milwaukee, was listed as the seventh most economically distressed city in America.[6]

Despite warnings from business, some economists argue that the skills gap is a myth. They cite recent trends of stagnant and declining wages as evidence, that, despite claims to the contrary, there is no spike in demand for workers.[7] Economists say it is implausible to suggest that a skills gap emerged out of the Great Recession, and that the persistent unemployment is a result of slow economic growth. "The structure of a modern economy does not change that quickly," said Stanford University economist Edward Lazear, a skills gap skeptic.[8]

Determining the cause of slow economic growth is a source of debate with many factors to consider. Nonetheless, business leaders in Wisconsin consistently complain of a lack of qualified workers. Whatever the causes, the current population of the Badger State is aging, the Baby Boomers are retiring, and if the next generation of workers isn't cultivated here, jobs will move elsewhere.

II. THE GROWTH OF THE STEM ECONOMY

One particular facet of the skills gap is how the demand for STEM-related jobs is outstripping labor supply. Georgetown University projects 779,000 jobs will be created nationwide between 2008 and 2018 that require a graduate degree in a STEM field.[9] But only 550,000 Americans are projected to earn graduate degrees in STEM in that time period.[10] A 2015 report from Deloitte projects that the next decade will see as many as 3.5 million new manufacturing jobs open up nationwide through growth, or retirement of Baby Boomers. As many as 2 million of those jobs could go unfilled because the current workforce is unprepared or unwilling to work in those jobs.[11]

Half of all STEM jobs in the United States are in manufacturing, healthcare, or construction industries, according to the Brookings Institute.[12] In Wisconsin – home to iconic names like Harley Davidson, Kohler, SC Johnson, and Rockwell Automation – one out of every six workers is employed in manufacturing. And manufacturing accounts for approximately 19% of the state's economic output.[13]

In a recent study of the STEM economy in major metropolitan areas around the country, the Brookings Institute found enormous opportunity for STEM educated workers both with, and without a college degree.[14] 20% of all jobs in the United States in 2011 required a high level of STEM knowledge.[15] These are doctors, engineers, medical professionals, and individuals with advanced knowledge in computer science or information systems. But half of all STEM jobs in the United States don't even require a four-year degree.[16] These are positions in advanced manufacturing, healthcare, construction, installation, and maintenance. For those without a four year degree, jobs in STEM fields earn on average 10% more than jobs with similar education requirements.[17]

In Wisconsin's two largest metropolitan areas, the Brookings Institute found evidence of these promising nationwide trends.[18]

Milwaukee-West Allis-Waukesha

• 21.4% of jobs in 2011 were STEM related.

• A little less than half - 48.5% - of those STEM jobs required a bachelor's degree. 51.5% required an associate's degree or less.

• Among all jobs, STEM jobs made on average $29,616 more than non-STEM jobs.

• Among all jobs requiring an associate's degree or less, STEM jobs made $21,691 more than their non-STEM counterparts.

Madison

• 24% of jobs in 2011 were STEM related.

• 58.7% of STEM jobs require a bachelor's degree. 41.3% of STEM jobs required an associate's degree or less.

• Among all jobs, STEM jobs made on average $28,446 more than non-STEM jobs.

• Among all jobs requiring an associate's degree or less, STEM jobs made $23,393 more than their non-STEM counterparts.

Yet, schools and businesses are increasingly worried that the American K-12 education system isn't adequately preparing enough students at proficient levels in math and science for a 21st century STEM economy.

According to one survey, just 29% of the general public and 16% of scientists think K-12 STEM education is above average in the United States.[19] Near even numbers, 39% of the general public and 38% of scientists, think K-12 STEM education is average. And 46% of scientists and 29% of the general public believe K-12 STEM education is below average compared to other industrialized countries.

Test scores have helped validate their fears. According to the 2012 results of the Program for International Student Assessment (PISA), an international benchmark test, American 15-year olds scored in the 35th percentile in math and 27th in science, among the 64 countries that take the test.[20] The US ranked 27th in math and 20th in science among the 34 developed nations in the Organization for Economic Cooperation and Development (OECD). This puts the United States behind many Western European nations like the United Kingdom and Germany, and far behind Asian competitors like South Korea, Taiwan, Japan, Vietnam, and Singapore.

For American students who want to work in STEM fields, their future is bright, fulfilling, and potentially quite lucrative. Be-

tween 2014 and 2024, employment in STEM related jobs is expected to grow at 16% in the United States, far outpacing all other employment fields.[21] These in-demand STEM jobs have higher wages than other fields, earning a median wage of $76,000 per year.[22]

But only if there are K-12 educational options that expose them to STEM.

III. STEM EDUCATION: A SOLUTION TO THE SKILLS GAP?

When most people think of STEM, they might know it has to do with a greater emphasis on science and math, and perhaps they've seen stories about kids building robots in school. That's all true, but it only captures the tip of the iceberg of this emerging and increasingly important curriculum field.

STEM does emphasize math and science, but it does so in a way that upends the traditional classroom to provide students with hands-on experience. A STEM education curriculum encourages problem solving, teaching students that there might be multiple ways to reach an outcome. It cultivates teamwork, and even allows students to fail as part of a learning process. STEM education also provides students with access to high-tech equipment like 3-D printers, giving them the know-how to operate the technology at the cutting edge of our information revolution.

Ultimately, a STEM curriculum prepares students for a 21st Century knowledge economy where technology and innovation are rapidly changing the landscape of manufacturing and industry.

Half of all STEM jobs in the United States don't even require a four-year degree

In an effort to shed light on what a quality STEM education looks like in practice, we profiled two schools in opposite corners of the state that are leading the way. Three Lakes School District, located in Oneida County, and LakeView Academy of Technology, located in Kenosha County, are two public schools that have implemented a STEM curriculum with impressive results.

THREE LAKES SCHOOL DISTRICT

Three Lakes, located 80 miles northeast of Wausau, is tucked between pristine lakes and expansive natural forest. The small community of just over 2,000 residents was settled as a logging community in the late 1800s and helped supply the material to rebuild Chicago in the wake of the Great Chicago Fire. Three Lake has always been about relying on the abundant resources in and around the community, and today that means equipping their students with the skills needed to thrive in the 21st Century economy.

Gene Welhoefer, Principal at Three Lakes School District for grades 7 to 12, said the district recognized the unique challenge posed by the skills gap and were encouraged to step up and address a problem that won't solve itself. In 2008, the school implemented a STEM curriculum and in 2014, tiny Three Lakes, with a high school of just 149 students, became the very first school in Wisconsin to open a K-12 Fab Lab, or fabrication laboratory. In association with the Fab Lab Foundation at Massachusetts Institute for Technology, Fab Labs are high-tech workshops equipped with common tools and common processes where students of all ages can learn to operate 3-D printers, robotics, and other high-tech fabrication tools.[23]

"We focus on STEM because it's cross curriculum," Welhoefer said. "It gives students an opportunity to use their strengths and their weaknesses and become better students and better learners."

Students agree. And they understand that their experience at Three Lakes is not only unique, but giving them a leg up on their peers in other districts.

Chase Kirby, a student at Three Lakes with aspirations of becoming a mechanical engineer, said, "I like the STEM focused education at Three Lakes because it provides a real hands on learning experience. In the Fab Lab, we're working with the tools and machines to create what we want. It gives us an opportunity to use new technology in the world that other students might not be able to, and it kind of gives that edge to be more prepared for our workplace in the future."

"The STEM focused education provides so many jobs for kids right out of high school without a degree from college," said CJ Schuette, a student interested in equine science.

Students say the STEM curriculum at Three Lakes teaches critical problem solving skills, and emphasizes that failure is a critical part of the innovation process.

"Failure is a great learning point here at Three Lakes," said Kirby. "Whenever we design a project and it doesn't work, we never give up. We always go back to the drawing board, find out what went wrong, what we can change that will make it better, and then test another design and see if that works."

Implementing a STEM curriculum has another positive effect: attracting high quality teachers. Before he became the director of the Three Lakes Fab Lab, Dr. Steven Yahr was an engineer for Lockheed Martin. His final project was serving on the design team for the Littoral Combat Ship that is constructed in Marinette, Wisconsin.

"After leaving Lockheed Martin, I never thought I was going to be able to do something cool again," he said. "This is cool."

With real-world experience in a STEM field, Yahr has a unique grasp of the importance of a STEM curriculum and why it's essential for students entering the 21st Century workforce.

"One of the challenges America faces, as we move from the Industrial Revolution to the Innovation Economy is helping students develop the 21st Century skills," he said, "which are creativity and innovation, critical thinking and problem solving, and communication and collaboration."

In just a few short years, the STEM curriculum at Three Lakes is already yielding impressive results.

Three Lakes is offering a training program in partnership with UW-Stout, called Fab Lab 101, for teachers at districts all over the state. The two-week immersion course has trained 17 teachers over two summers in how to teach and develop STEM curriculum that best fits their students, their school, and their local community.

As for the students, one recent graduate was approached by a local business owner to learn and potentially take over the business someday. And a first grader made a chess set of his own design using a 3-D printer.

Yahr takes special pride in saying he is able to look at the students at Three Lakes and say, "I would love to have some of these students as part of my team."

LAKEVIEW TECHNOLOGY ACADEMY

Located across from Lake Andrea in Kenosha County, LakeView Technology Academy serves more than 400 students in one of the most unique educational settings in Wisconsin. Part of the Kenosha Unified School District, LakeView opened its doors in 1997 with a mission to prepare students to enter the workforce, attend a technical college, or to enter a university to study engineering, math, or science.

"After leaving Lockheed Martin, I never thought I was going to be able to do something cool again"

But LakeView struggled in its initial years. The school wasn't attracting strong students. LakeView scored last of all schools in a three county region on the Wisconsin Knowledge and Concepts Examination (WKCE).[24] The curriculum was antiquated, failing to engage students with emerging technology and the possibility of fulfilling work.

New leadership and a revamped curriculum turned LakeView around. In 2003, LakeView adopted a STEM curriculum under the new direction of Principal William Hittman and the school quickly became one the best performing public schools in Kenosha County.

"The reason STEM curriculum is so important is, every August, I get the data from the U.S. Department of Labor. And the ten most in demand occupations over the next ten years, nine of those occupations are in STEM: science, technology, engineering, and mathematics. Five of those require an associate's degree. Five require a college degree. That's the reason why we stress STEM here," Hittman said.

Lakeview also has a unique partnership with Gateway Technical College in Kenosha. "Our STEM program is different from other schools to the extent that we are partnering with our technical college, so we use faculty from the technical college," said Principal Hittman. "We do budgeting together. We procure equipment together. We have the most updated equipment that's available."

At Lakeview, classes can sometimes look more like laboratories than the traditional layout of desks and chairs – although they have those too. Students can be found working in computer labs, with robots, with 3-D printers, or with an electron emitting microscope.

Between 2014 and 2024, employment in STEM related jobs is expected to grow at 16% in the United States, far outpacing all other employment fields

"LakeView's Fab Lab has 3-D printers from Dremel. We were one of the first to have 3-D printers in the state. We have CNC mills, CNC lathes. We have a laser cutter. We tie all this together as a system, so our students learn the automated manufacturing systems in terms of a systems approach to learning," said Hittman.

Lakeview participates in Project Lead the Way (PLTW), a nationally recognized non-profit organization that assists schools with STEM curriculum and teacher development. The results have been a more engaged student body that is excited about problem solving, learning, and exposure to new technology.

But exposure to high-tech equipment is only part of the equation. It is the process of learning that prepares LakeView students for future STEM careers.

"The key to a Fab Lab is that the kids learn the whole systems. They do the design work. They do the drawings. They do the manufacturing. They do the testing and measuring, the follow through, all the way up through the packaging. That's a systems approach and that's what business and industry wants. They want kids to know everything from the beginning to the planning, all the way to the end to the shipping," said Hittman.

Eric Sutkay, a teacher at LakeView, added, "Our STEM program is successful because we encourage the students to get involved in a variety of different things: clubs, organizations. And, it helps them be successful in the classroom."

Alongside volunteer organizations like Habitat for Humanity, Sutkay said student involvement also includes participation in things like robotics teams and the construction of a super high mileage vehicle.

"It's not all about the equipment. A lot of it is about the projects and the interaction of the students within the project, how they create things, problem solve. How they bounce ideas off of each other is key, so it's not necessarily the equipment, but the project and the means of getting to the end of the project," said Sutkay.

STEM works at LakeView because of a dedicated, mission-oriented staff committed to students and focused on preparing them for the 21st Century workforce. Upon graduation, LakeView students have the equivalent of one year of technical college credits or one semester of credits applicable at a college of engineering.

"Since we instituted STEM at our school, the successes have been phenomenal. Students received four-year full-paid scholarships. Our students are actually getting scholarship money to go off to technical colleges. Our students are being recruited by the business and industries here. Our students are being recruited by colleges and universities. They're coming to us instead of us going to them," said Principal Hittman.

IV. KEYS TO CULTIVATING STEM EDUCATION IN WISCONSIN

In interviews with school leaders, we found the following keys to cultivating successful STEM education programs in Wisconsin:

TEACHER LICENSING REFORM

A successful STEM education is more than just the acquisition of high-tech equipment and computers. In fact, those 3-D printers and electron-emitting microscopes are useless without teachers who have the know-how, the passion, and the drive to make STEM education engaging and applicable to their students. But attracting teachers, particularly teachers trained in technical education and STEM, has become increasingly difficult as the nation faces a well-documented teacher shortage. According to the National Association of State Directors of Career Technical Education Consortium, the teacher shortage in technical education has been the result of retirements, increased demand for technical education courses, and an 11% decrease in career technical education teacher education programs between 1990 and 2000.[25]

With a shortage of STEM and technical education teachers, education reformers have looked to expand the pool of potential teachers by drawing in experienced career professionals to the teaching field. Doing so runs right into the debate over teacher licensure. Principal Hittman at LakeView was quite blunt saying, "The biggest legal barrier to providing qualified STEM teachers in our high schools is the licensing of those teachers. There's very good people in business and industry with engineering degrees, technology backgrounds. And, with some, a little bit of additional training, they can come into our schools, and they have come into our schools and have done an excellent job."

Real-world experience matters in STEM and technical education. Working in industry and familiarity with cutting edge technology can enhance the classroom experience for students in a STEM curriculum. Actually knowing how to use a 3-D printer, for instance, or having experienced the team-based collaborative problem-solving method used by engineers is extremely valuable.

"Currently, there is no Fab Lab certification. There is no STEM certification," said Principal Welhoefer of Three Lakes. "What you need are highly qualified teachers who are able to teach the curriculum that you have in their subject areas."

Welhoefer says, often times, finding those teachers requires looking outside of the box and then determining if a qualified individual is capable of teaching.

In 2015 and 2016, the Wisconsin State Legislature worked to address this issue by creating new alternative pathways to attain an initial teacher license in technical education.

The 2015-2016 state budget created a new points system for an experience-based teacher license. While there are still teacher education curriculum and supervision requirements for prospective teachers, professional experience is now counted as an equivalent to various education requirements. According to the Wisconsin Legislative Council, the new license "assigns points both for experience in a technical field and for pedagogical experience," so professional experience is now rewarded along with education background. [26] This is meant to attract qualified professionals into the teaching profession without pointing them towards a multi-year expensive teacher education program.

In spring 2016, State Sen. Alberta Darling and Rep. Dan Knodl authored SB 449 that added career vocational fields to the experience-based teacher license. These new fields include agriculture, child services, clothing services, food services, housing and equipment services, family and consumer education, family and consumer services, home economics-related occupations, health care-related occupations, business education, and marketing education. The bill was signed into law as Wisconsin Act 259 in March 2016.

While this reform was met with opposition from the Wisconsin Department of Public Instruction, the teacher's union, and the teacher colleges, there has been early documented successes. A few months after the bill was signed into law, 19 teachers had acquired the new experience-based license before the traditional spring hiring period. The Milwaukee Journal Sentinel profiled two new teachers at Brown Deer High School, near Milwaukee, with backgrounds in construction that were now teaching shop class – a traditionally difficult position to fill.[27]

Principal Hittman at Lakeview expressed support for the recent reforms.

"Our state legislature realizes that they have to help us provide trained STEM teachers, so they've modified the statutes and the laws that people that don't have teaching degrees, but have other degrees, engineering and so forth, with a little bit of training and so forth, can get a license and come into our schools. I have one of those people there, and they do an excellent job," he said.

"The biggest legal barrier to providing qualified STEM teachers in our high schools is the licensing of those teachers."

Nevertheless, attracting new teachers is an urgent task that requires more bold thinking. Despite modest reforms to open up teaching to a greater pool of potential educators, Wisconsin still lacks a true alternative pathway to licensure that circumvents the schools of education. With the decline in enrollment at the schools of education, the state should encourage the creation of teacher residency programs. RELAY, a successful charter school teacher residency program, takes applicants with a bachelor's degree and gets them in the classroom in year one as an assistant, all while taking coursework in the evening and getting paid.[28] By year two, the residents are

teaching while continuing their coursework. Graduates receive the equivalent of a master's degree in two years all while working in a classroom on day one and earning a paycheck.

PROJECT LEAD THE WAY (PLTW)

For schools that want to adopt STEM education, acquiring equipment may actually prove to be the easy part. Adopting a STEM curriculum is perhaps one of the biggest hurdles for any school implementing a STEM focus. Fortunately, resources are available through Project Lead the Way (PLTW), a non-profit dedicated to developing STEM curriculum and providing professional development for STEM instructors.

"It's not all about the equipment. A lot of it is about the projects and the interaction of the students within the project, how they create things, problem solve."

What started in 1986 with a high school science teacher in upstate New York who wanted to teach pre-engineering courses has developed into nationwide network of more than 8,000 programs in 9,000 schools. Officially founded in 1997, PLTW has become the leader in developing K-12 STEM curriculum.

Starting with a Launch curriculum for kindergarten through fifth grade, students in elementary school are taught problem-solving and collaboration, and are exposed to the foundations of biology, physics, programming, and robotics. For middle school, PLTW developed the Gateway curriculum that includes design and modeling, automation and robotics, as well as courses in engineering, biomedical science, and computer science. In high school, students are offered three STEM pathways in Engineering, Biomedical Sciences, and Computer Science. Each track offers a unique curriculum designed to prepare students for entrance into the workforce or a college-level education.

To implement the PLTW curriculum, the organization is committed to providing professional development for the instructors. Using a three-tiered system, PLTW provides basic readiness courses, an in-depth core training that oftentimes takes place at a PLTW affiliate university, and then ongoing training that will often take place online. These courses ensure that STEM instructors are equipped with the knowledge and confidence to implement the various training modules and curriculum pathways.

In addition to a more engaging classroom, students who complete a Project Lead the Way curriculum are eligible to take the PLTW assessment for each course. Successful completion can count towards college credit at affiliate universities like the Milwaukee School of Engineering (MSOE), along with nationally renowned universities like Purdue, Rose-Hulman, and Cal-State Polytechnic. Project Lead the Way currently has 63 university affiliates that span the entire country.

Recent research has shown that PLTW is an effective means of increasing the number of STEM graduates. Researchers from the Center for Urban and Multicultural Education at Indiana University-Purdue University Indianapolis (IUPUI) examined almost 60,000 Indiana high school graduates. The study found that students who participated in PLTW were majoring and graduating in STEM fields[29] and that the completion of three or more PLTW engineering courses resulted in higher persistence rates from first to second year students than those who were not PLTW students.[30] A 2013 study by a Texas State University researcher found that PLTW students were better prepared for higher education, attended Texas higher education institutions at a higher rate than non-PLTW students, and had higher scores on the state's math assessment.[31] In addition, the median wage of PLTW students who didn't attend an institution of higher education were 13.6% higher than their non-PLTW peers.[32]

Fortunately, Wisconsin has embraced PLTW. More than 400 Wisconsin public schools in 161 school districts offer Project Lead the Way programs[33] and more than 1,000 teachers have been trained in the PLTW curriculum.[34]

Given the proven results of Project Lead the Way, the expansion of PLTW to all corners of Wisconsin is a positive trend.

LOCAL PARTNERSHIPS WITH BUSINESSES

The local business communities stand to benefit from close partnership with schools committed to STEM education; right in their own backyard is the workforce of tomorrow. Schools should continue to foster these public-private partnerships.

Wil Lambert of Formed By Design LLC, a Milwaukee-based company that does CNC and partners with LakeView, sees

STEM education as essential to the local economy.

"Businesses need to be involved with STEM education because they can start helping the students focus on the training and the skills that are needed in the areas that the students live," he said. "We've helped some students get involved with summer internship programs that have turned into full-time job after high school like running CNC machines, wiring EDM machines, manufacturing for the aerospace industries, satellites, and medical components."

Lambert credits the STEM education with properly preparing students for the current demands of the job market.

"The students are up to the challenge in these different industries because of the skills sets they develop in school based on the software they're exposed to, the different machinery they're exposed to, and also the local businesses being involved directly with the schools to try to create programs and help the students advance in their careers early on."

LakeView also has a partnership with Gateway Technical College in nearby Kenosha that pools resources for the benefit of both schools.

"I think the relationship that we built with LakeView helps us overcome some of the hurdles around funding," said Bryan Albrecht, President of Gateway Technical College in Kenosha. "We really gauged this effort on a public/private partnership, so we expect our companies and our communities to invest in LakeView because we're providing a service for them of a highly skilled workforce, but we're also reallocating resources within the college to make sure that we invest in programs that are going to help our faculty grow and develop those relationships with our K-12 partners."

Albrecht noted that the local business community and their deep investment in developing a local workforce is a huge key to success.

"Business is the foundation for our success between Gateway and LakeView," said Albrecht.

In Three Lakes, Mike Kwaterski, owner of Kwaterski Brothers Wood Products and a member of the local Business Advisory Council, says business owners are starting to understand the value of STEM education.

"As a business owner, [Three Lakes] curriculum is so important because it incorporates 21st Century skills that they now experience at the high school level," he said. "When they come into us at the workforce, they've already had that experience."

Kwaterski said he has seen firsthand how students at Three Lakes are already making an impression on the local business community, long before they graduate.

Even more promising is that these types of partnerships are emerging at schools all over Wisconsin who have invested in STEM education. In Brillion, Wisconsin, a town with a population of just over 3,000, the Ariens Company invested $1.5 million in the Brillion High School for a STEM and technical education space second to none.[35] With this investment, Brillion High School has become a magnet for area students interested in STEM and technical education, and the Ariens Company, one of the top manufacturers in the state of Wisconsin, is hiring Brillion graduates as interns and eventual employees.

FAB LAB AND FAST FORWARD GRANTS FROM THE STATE

To cultivate the growth of STEM education in Wisconsin, the state has opened up new avenues to resources for schools looking to invest.

To meet the growing demand for Fab Labs, the 2015-2016 state budget set aside up to $500,000 in grant dollars as part of the Fab Labs Grant Program administered through the Wisconsin Economic Development Corporation (WEDC).

Fab Labs, or Fabrication Labs, have been a key component of STEM education. Affiliated with the Massachusetts Institute of Technology (MIT) Center for Bits and Atoms, Fab Labs are "a technical prototyping platform for innovation and invention, providing stimulus for local entrepreneurship," according to the Fab Foundation.[36] Each Fab Lab is a small workshop that provides "widespread access to the modern means for invention."[37]

The common tools found in each Fab Lab are "a laser cutter that makes 2D and 3D struc-

According to WEDC, 25 school districts out of 90 applicants across the state applied for and received Fab Lab grants in 2015-16 ranging from $10,790 to $25,000

tures, a sign cutter that plots in copper to make antennas and flex circuits, a high-resolution NC milling machine that makes circuit boards and precision parts, a large wood router for building furniture and housing, and a suite of electronic components and programming tools for low-cost, high-speed microcontrollers for on-site rapid circuit prototyping."[38] Students are taught how to create and design via computer software and then are able to direct the machinery, 3-D printers or CNC machines, to manufacture different devices, tools, and parts.

"Businesses need to be involved with STEM ducation because they can start helping the students focus on the training and the skills that are needed in the areas that the students live."

According to WEDC, 25 school districts out of 90 applicants across the state applied for and received Fab Lab grants in 2015-16 ranging from $10,790 to $25,000.[39] The grants require some matching funds from the school district.

Another $500,000 will be made available as part of the 2017-18 state budget proposal to meet the growing demand.

In addition to Fab Lab grants, the Wisconsin Fast Forward program was created in 2013 to serve as a "training and skills development catalyst" to encourage employers and educators to apply for state grants to develop training programs for in-demand jobs in manufacturing, construction, and customer service. Up to $15 million was made available for worker training grants administered by the Department of Workforce Development's new Office of Skills Development

Wisconsin Fast Forward was quickly boosted in 2014 with the passage of Gov. Walker's Blueprint for Prosperity, a $35 million plan to decrease technical college waitlists and facilitate training for high school students looking to get certified in in-demand career fields.[40]

According to the 2015 annual report on Wisconsin Fast Forward, the Blueprint for Prosperity grants trained more than 2,000 high school students in 75 different local projects.[41] For example, 20 high school students at the New Berlin School District were trained and certified as certified nursing assistants with a $27,000 grant. Upon completion, the students had credits towards Waukesha County Technical College, their CNA certification, and job placement at local healthcare facilities.[42]

The DWD also administers the Youth Apprenticeship Program, a grant program to give high school students in Wisconsin the opportunity to explore career options and learn a skill or trade. The program serves approximately 3,600 Wisconsin students who primarily work in either manufacturing or health services.[43] Governor Walker announced $3.2 million in Youth Apprenticeship grants available for the 2016-17 school year.[44]

V. CONCLUSION

Fostering STEM education to develop a skilled workforce in Wisconsin is a tangible goal with the potential for a strong return on investment. The results at LakeView and Three Lakes reveal that a quality STEM curriculum can put students in a position to succeed – whether it is right out of high school, at a technical college, or at a university studying engineering, math, medicine, or science. What is more, LakeView and Three Lakes are not alone. Dozens of school districts in every corner of the state have adopted STEM programs with the support of their local business community. This progress reflects a greater recognition in education, business, and government that addressing the skills gap by cultivating a skilled work force is not just a challenge, but a generational opportunity.

Lessons Learned:

- Wisconsin is on the right track – In recent years, leaders in government, business, and education have responded in a positive and productive way to the challenge of equipping students to flourish in the 21st century economy. Through focus, investment, commitment, and innovation, more and more schools in Wisconsin have the resources and will to offer their students a STEM education that equips them with in-demand skills, valuable knowledge, and encouragement to create.
- Local investment pays off - Building support and buy-in from the local business community is critical to success. Local manufacturers and technology companies ought to be invited to the table to have input on curriculum and to explain to educators what type of training they look for in potential employees. The most successful STEM schools in the state have close partnerships with local businesses, who will often donate funds, material, and technology. They, in turn, see the fruits of this investment in internships, apprenticeships, and full-time employees.
- Resources are available – Despite persistent complaints about a lack of funding for K-12 education, a vast array of resources have been made available for STEM education. From Fab Lab grants and the Wisconsin Fast Forward program, to foundational

and business investment, to the curriculum and professional development offered by Project Lead the Way, schools seeking to offer a STEM education should know that there are willing partners ready to assist. One area that can be improved is in creating true alterative pathways to teacher licensure that could get qualified professionals in the classroom sooner.

While the challenge and consequences of the skills gap will often get the headlines, there are a lot of positive things happening in Wisconsin that deserve to be highlighted. The success of schools like LakeView and Three Lakes, the major local investment from companies like Ariens, and the untold stories of inspiration, creativity, and professional success resulting from STEM education programs in Wisconsin are worthy of exposure. It is this success, at the school level, that will overcome antiquated stigmas about manufacturing, open up new avenues for students, and encourage teachers and school leaders to inspire their students to aim for the jobs of tomorrow.

Endnotes

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