

**OUR NATION OF BUILDERS: TRAINING THE  
BUILDERS OF THE FUTURE**

---

---

**HEARING**  
BEFORE THE  
SUBCOMMITTEE ON COMMERCE, MANUFACTURING,  
AND TRADE  
OF THE  
COMMITTEE ON ENERGY AND  
COMMERCE  
HOUSE OF REPRESENTATIVES  
ONE HUNDRED THIRTEENTH CONGRESS

FIRST SESSION

NOVEMBER 15, 2013

**Serial No. 113-97**



Printed for the use of the Committee on Energy and Commerce  
*energycommerce.house.gov*

U.S. GOVERNMENT PUBLISHING OFFICE

92-985 PDF

WASHINGTON : 2015

---

For sale by the Superintendent of Documents, U.S. Government Publishing Office  
Internet: [bookstore.gpo.gov](http://bookstore.gpo.gov) Phone: toll free (866) 512-1800; DC area (202) 512-1800  
Fax: (202) 512-2104 Mail: Stop IDCC, Washington, DC 20402-0001

COMMITTEE ON ENERGY AND COMMERCE

FRED UPTON, Michigan

*Chairman*

RALPH M. HALL, Texas	HENRY A. WAXMAN, California
JOE BARTON, Texas	<i>Ranking Member</i>
<i>Chairman Emeritus</i>	JOHN D. DINGELL, Michigan
ED WHITFIELD, Kentucky	FRANK PALLONE, Jr., New Jersey
JOHN SHIMKUS, Illinois	BOBBY L. RUSH, Illinois
JOSEPH R. PITTS, Pennsylvania	ANNA G. ESHOO, California
GREG WALDEN, Oregon	ELIOT L. ENGEL, New York
LEE TERRY, Nebraska	GENE GREEN, Texas
MIKE ROGERS, Michigan	DIANA DeGETTE, Colorado
TIM MURPHY, Pennsylvania	LOIS CAPPS, California
MICHAEL C. BURGESS, Texas	MICHAEL F. DOYLE, Pennsylvania
MARSHA BLACKBURN, Tennessee	JANICE D. SCHAKOWSKY, Illinois
<i>Vice Chairman</i>	JIM MATHESON, Utah
PHIL GINGREY, Georgia	G.K. BUTTERFIELD, North Carolina
STEVE SCALISE, Louisiana	JOHN BARROW, Georgia
ROBERT E. LATTA, Ohio	DORIS O. MATSUI, California
CATHY McMORRIS RODGERS, Washington	DONNA M. CHRISTENSEN, Virgin Islands
GREGG HARPER, Mississippi	KATHY CASTOR, Florida
LEONARD LANCE, New Jersey	JOHN P. SARBANES, Maryland
BILL CASSIDY, Louisiana	JERRY McNERNEY, California
BRETT GUTHRIE, Kentucky	BRUCE L. BRALEY, Iowa
PETE OLSON, Texas	PETER WELCH, Vermont
DAVID B. MCKINLEY, West Virginia	BEN RAY LUJAN, New Mexico
CORY GARDNER, Colorado	PAUL TONKO, New York
MIKE POMPEO, Kansas	JOHN A. YARMUTH, Kentucky
ADAM KINZINGER, Illinois	
H. MORGAN GRIFFITH, Virginia	
GUS M. BILIRAKIS, Florida	
BILL JOHNSON, Ohio	
BILLY LONG, Missouri	
RENEE L. ELLMERS, North Carolina	

---

SUBCOMMITTEE ON COMMERCE, MANUFACTURING, AND TRADE

LEE TERRY, Nebraska

*Chairman*

LEONARD LANCE, New Jersey	JANICE D. SCHAKOWSKY, Illinois
<i>Vice Chairman</i>	<i>Ranking Member</i>
MARSHA BLACKBURN, Tennessee	JOHN P. SARBANES, Maryland
GREGG HARPER, Mississippi	JERRY McNERNEY, California
BRETT GUTHRIE, Kentucky	PETER WELCH, Vermont
PETE OLSON, Texas	JOHN A. YARMUTH, Kentucky
DAVID B. MCKINLEY, West Virginia	JOHN D. DINGELL, Michigan
MIKE POMPEO, Kansas	BOBBY L. RUSH, Illinois
ADAM KINZINGER, Illinois	JIM MATHESON, Utah
GUS M. BILIRAKIS, Florida	JOHN BARROW, Georgia
BILL JOHNSON, Ohio	DONNA M. CHRISTENSEN, Virgin Islands
BILLY LONG, Missouri	HENRY A. WAXMAN, California ( <i>ex officio</i> )
JOE BARTON, Texas	
FRED UPTON, Michigan ( <i>ex officio</i> )	

## C O N T E N T S

---

	Page
Hon. Lee Terry, a Representative in Congress from the State of Nebraska, opening statement .....	1
Prepared statement .....	2
Hon. Janice D. Schakowsky, a Representative in Congress from the State of Illinois, opening statement .....	3
Hon. Leonard Lance, a Representative in Congress from the State of New Jersey, opening statement .....	5
Hon. Gus M. Bilirakis, a Representative in Congress from the State of Flor- ida, opening statement .....	5
Hon. Bill Johnson, a Representative in Congress from the State of Ohio, opening statement .....	6
Hon. Jerry McNerney, a Representative in Congress from the State of Cali- fornia, opening statement .....	6
Hon. Henry A. Waxman, a Representative in Congress from the State of California, prepared statement .....	67
WITNESSES	
Jennifer McNelly, President, The Manufacturing Institute .....	8
Prepared statement .....	10
Answers to submitted questions .....	69
Allyson Knox, Director of Education Policy and Programs, Microsoft Corpora- tion .....	15
Prepared statement .....	17
Answers to submitted questions .....	73
Sandra Westlund-Deenihan, Chief Executive Officer and Design Engineer, Quality Float Works, Incorporated .....	36
Prepared statement .....	38
Answers to submitted questions .....	78
Lazaro Lopez, Associate Superintendent, Township High School District 214, State of Illinois .....	43
Prepared statement .....	45
Answers to submitted questions <sup>1</sup> .....	85
Catherine Hill, Director of Research, American Association of University Women .....	52
Prepared statement .....	54
Additional material for the record <sup>2</sup> .....	

<sup>1</sup>Mr. Lopez did not answer submitted questions for the record by the time of printing.

<sup>2</sup>The report "Women In Community Colleges: Access to Success" submitted by Ms. Hill is available at <http://docs.house.gov/meetings/IF/IF17/20131115/101480/HHRG-113-IF17-Wstate-HillC-20131115-SD001.pdf>.



# OUR NATION OF BUILDERS: TRAINING THE BUILDERS OF THE FUTURE

FRIDAY, NOVEMBER 15, 2013

HOUSE OF REPRESENTATIVES,  
SUBCOMMITTEE ON COMMERCE, MANUFACTURING, AND  
TRADE,  
COMMITTEE ON ENERGY AND COMMERCE,  
*Washington, DC.*

The subcommittee met, pursuant to call, at 9:35 a.m., in room 2123, Rayburn House Office Building, Hon. Lee Terry (chairman of the subcommittee) presiding.

Members present: Representatives Terry, Lance, Blackburn, Guthrie, Olson, Pompeo, Kinzinger, Bilirakis, Johnson, Long, Schakowsky, McNerney, and Barrow.

Staff present: Charlotte Baker, Press Secretary; Kirby Howard, Legislative Clerk; Nick Magallanes, Policy Coordinator, Commerce, Manufacturing, and Trade; Brian McCullough, Senior Professional Staff Member, Commerce, Manufacturing, and Trade; Gib Mullan, Chief Counsel, Commerce, Manufacturing, and Trade; Shannon Weinberg Taylor, Counsel, Commerce, Manufacturing, and Trade; Michelle Ash, Democratic Chief Counsel, Commerce, Manufacturing, and Trade; and Will Wallace, Democratic Professional Staff Member.

Mr. TERRY. Good morning. Thank you. I want to welcome all of our witnesses, and I will introduce you as a panel after the opening statements just before we start your testimony.

## OPENING STATEMENT OF HON. LEE TERRY, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF NEBRASKA

So I am going to go ahead and begin my statement and welcome all of our witnesses here. This is the sixth installment in “Our Nation of Builders” series. And the subject matter we are discussing today brings together a common thread from all of our witnesses who have previously testified, that the demands for middle- or semiskilled workers within the manufacturing industry is an across-the-board issue. I will be blunt—everyone testified that they have job openings that they have difficulty filling in today’s advanced manufacturing because of the lack of middle-skilled workers.

So with that, we have seen a variety of different ways of creating their own. We had Toyota here, who created their own community college, on campus, to be able to teach the skills that are necessary in operating today’s more modern equipment.

I visited in Omaha an old tool-and-die shop. That when I was 13, my brother-in-law and his dad had a tool-and-die shop, and I—my job was to sweep up all the metal shavings. That was really my first—well, it wasn't really a real job. But they would also teach me how to run one of the lathe machines. In today's world, if you walk into a similar tool-and-die shop, like I did at Tri-V, a family-owned tool-and-die shop, you would see that everything has computer screens and keyboards to operate them.

And they talk about how many job openings, and they found—they introduced me to a high school girl from Bellevue West High School, a senior, that is in a Dream It. Do It. program, and they have told her if she works for them, they will pay for her 2 years at the community college, Southeast Community College, one of the couple that are left.

So business is trying to figure out a way around this. But we have identified this, and Jan has particularly been dogged on this issue, what can we do in Congress to make sure that those folks coming out of high school today have the requisite skills to walk into any manufacturing and have a job and can be successful in that job?

Why it is so important is, A, I think just our basic economy. If we aren't making things, then where—where is our middle class going to come from? Historically the middle class has come from the manufacturing sector. Everyone that testified, the small foundry in Jan's district or the fabricator in my district, they walk in in Omaha, Nebraska, and start at 40,000. We learned in the automobile industry and the steel industry, you walk in, you are earning \$77,000 to 80,000 with those skills. That is what built America, that is what builds our economy, and that is what builds families, frankly. That is a successful family when they can walk into a manufacturing plant and earn 70- or \$80,000 a year.

So we need to get that back in this country. The Great Recession, we lost 5 million manufacturing jobs. Fortunately, we have regained 500,000 of that, mostly through the energy, steel, automobile industries. But a question lingers: If we can successfully get 4.5- new manufacturing jobs in this United States, how do we get the labor? So while this strengthens families and provides hope for people with—that don't want to go to school that—to college that they can have a successful job and raise their families, and meet their expectations, where are those people going to come from?

And so we have educators here today. We have a variety of people that are involved in STEM education, because all of the folks, manufacturers who have testified before this said it really comes down to our STEM education in the United States.

[The prepared statement of Mr. Terry follows:]

#### PREPARED STATEMENT OF HON. LEE TERRY

Good morning and welcome to today's hearing—the sixth installment in our Nation of Builders series.

The subject matter we will be discussing today brings together a common thread that appeared in almost all of our manufacturing hearings: the demands that our manufacturing renaissance is placing on our workforce—especially workers trained in science, technology, engineering and math—is resulting in a current and future shortfall of workers.

Several witnesses testified-whether it was the local foundry or Toyota-that they are having problems finding skilled workers with the requisite STEM skills to fill 21st century manufacturing jobs. More concerning was the fact that many of these companies said the problem only gets worse in the future. If the United States cannot supply the type of labor needed to fill these good jobs, these companies may choose to operate in a nation that can. When a company cannot find the workers it needs to fill certain jobs, we are hamstringing productivity, potential for growth, and competitiveness.

According to the Manufacturing Institute, STEM jobs are projected to grow by 17 percent between 2008 and 2018. 56 percent of manufacturing executives already believe that the skilled workforce shortage we are experiencing will increase over the next 3 to 5 years, culminating in a projected shortage of as many as 700,000 unfilled skilled jobs by 2020.

The good news is that this problem hasn't gone completely unnoticed. As many as 252 STEM education activities or programs are currently being run by several different Federal agencies. Yet we are still facing a reality where technology companies like Microsoft cannot find trained computer technicians and the local foundry in Omaha cannot fill openings it has for welders. Clearly there is work to be done.

As Dr. Hill aptly points out in her testimony, many of these STEM jobs are "middle-skill" jobs that require more than a high school education but less than a bachelor's degree. And on average, these middle skills jobs earn 40 to 60 percent more than non-STEM positions. The same distinction is true for other STEM workers, who earn 26 percent more than their respective counterparts. These are good jobs that provide employees great benefits, and ample on the job training so they can keep moving up in the 21st century economy.

Congress needs to come up with fresh ideas on how we can continue to train the next generation of builders, programmers, manufacturers, technicians and entrepreneurs. There is surely going to be more than one answer, and working with the private sector to leverage our potential will be a must. I would like to thank today's witnesses for attending and I look forward to your testimony.

Mr. TERRY. So I want to thank all of our witnesses, and I am going to recognize our ranking member of the subcommittee, who has probably at least once a week since we started this said, "When is our STEM hearing?," Jan Schakowsky.

**OPENING STATEMENT OF HON. JANICE D. SCHAKOWSKY, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF ILLINOIS**

Ms. SCHAKOWSKY. And here we are. So thank you very much, Mr. Chairman.

I want to thank all of our witnesses that are here today, but I take special pride in welcoming Dr. Laz Lopez, who I would like to say is a friend, but also, since I have met him, as an outstanding educator. Before taking over as now associate superintendent for teaching and learning for School District 214, Dr. Lopez spent 6 years as principal of Wheeling High School, a neighborhood public school. He implemented the STEM for all initiatives, ensuring that all students graduate with a Diploma Plus, so that they can compete for 21st century jobs. Over his time as principal, Wheeling High School set the highest ACT scores in the school's history and improved its performance on Advanced Placement tests.

Wheeling High School is recognized for its outstanding STEM program by our Governor Pat Quinn and many educational organizations. Last year Dr. Lopez was recognized as the Illinois Principal of the Year. And I am so glad to have him here, and I know his insight is going to be tremendously valuable as we consider how to prepare our students for the jobs of tomorrow. With total respect, I say, if Wheeling High School can do it, we can do it everywhere in this country.

In our previous hearings the series of “Nation of Builders,” we have heard from home builders and steelmakers and automakers and other manufacturers. Many witnesses have expressed a demand for more American workers who are able to handle the advanced manufacturing jobs of the future, really of today and the future, jobs that require STEM literacy. A well-educated workforce is a basic requirement for a strong domestic manufacturing sector. The U.S. manufacturing sector is growing, but that can’t continue if we do not adequately prepare our workforce especially as we face increased competition from nations around the world.

My congressional district is home to the Illinois Science and Technology Park, where innovative companies are hard at work developing nanotechnology, biotechnology, and flexible electronic products, among others. Those companies represent the future of advanced manufacturing in America, and their employees have to have strong STEM backgrounds.

The State of Illinois has been a leader in STEM education and training through the State’s Illinois Pathways Race to the Top program. The Illinois Science and Technology Institute was chosen to lead a learning exchange focused on STEM education. The learning exchange will last 3 years, allowing students and their teachers to work collaboratively with businesses—I think that is a key to the program I hope we will hear more about—to improve STEM education and expand opportunities for hands-on STEM experiences for students.

The Federal Government has also played a role in STEM. The Obama administration has made significant efforts to develop tomorrow’s workforce, engaging in public-private partnerships to improve STEM, encouraging more girls, women, and minorities to pursue STEM courses and careers, and recognizing and rewarding the best teachers in the STEM fields. Congress has supported STEM training through the passage and reauthorization of the America Competes Act, among other efforts. And I am hopeful that the bipartisan focus on STEM that you are going to see here today will continue.

I think we all agree that preparing today’s students for tomorrow’s jobs should be a priority. I look forward to hearing from our witnesses representing high schools, universities, large corporations, and small businesses that are leaders in STEM education and employment. I hope to learn about how their successes can be replicated, and how their remaining challenges can be addressed.

I really am hopeful that this subcommittee is going to take the lead; that we are going to provide a blueprint for the rest of our colleagues, for the rest of the Congress, on how we can meet the challenges of our students, of our businesses and of our economy in the United States.

Thank you, Mr. Chairman.

Mr. TERRY. Thank you.

Now recognize the gentleman from New Jersey, the vice chair of this subcommittee, for his 5 minutes.

**OPENING STATEMENT OF HON. LEONARD LANCE, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF NEW JERSEY**

Mr. LANCE. Thank you, Mr. Chairman, and good morning to the distinguished panel. I apologize if I am in and out; there is also a Health Subcommittee hearing this morning. But let me say I consider this to be an extremely important topic to the future of the Nation. And this is the way Congress should work, in a completely bipartisan fashion, because we are all deeply concerned about this issue, and it affects the middle class, and we all want a strengthened middle class.

The so-called STEM, science, technology, engineering, and math sector, plays an integral role in New Jersey, the State I have the honor of representing. According to a study commissioned by the Public Policy Institute at Georgetown, New Jersey will need a total of approximately 248,000 STEM jobs by 2018, up from approximately 223,000 in 2008. This represents an 11 percent increase in STEM jobs, and 93 percent of these jobs will require postsecondary education and training.

In New Jersey's Seventh Congressional District, the STEM field plays a particularly important role in the economy. The pharmaceutical, telecommunications, and manufacturing companies in the district I serve employ STEM graduates. Institutions such as Union County Magnet High School prepare students to compete for these high-paying, high-quality STEM jobs.

However, despite the gains of manufacturing jobs the United States has seen recently and the increase of STEM jobs, there are many questions as to whether or not we will be able to meet the demand for STEM jobs in the future. Hence, today we examine the skills gap the United States faces between the number of qualified STEM candidates for jobs and the vacancies employers have for these jobs, a gap that is almost certain to widen if a solution cannot be found. This gap threatens the ability of the United States to compete with other countries around the world in these important fields now and certainly in the future.

Today's panel is distinguished in academic, manufacturing, and technological worlds, on the front line to narrow the skills gap in this country and realize the Nation's vision of being at the forefront of 21st century innovation. I look forward to hearing from your perspectives on this critically important issue, and I am certainly welcome to yield time to Mr. Bilirakis from Florida.

**OPENING STATEMENT OF HON. GUS M. BILIRAKIS, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF FLORIDA**

Mr. BILIRAKIS. Thank you so much. I appreciate it.

Thank you for holding this hearing as well, Mr. Chairman.

Successfully training the builders of the future is vital to the economic well-being of our country. This training should focus on in-demand industries; enhance opportunities for individuals to be placed in quality, well-paying, private-sector jobs; and respond to the needs of employers so economic growth can be sustained. One area of promise is on-the-job training and apprenticeships for students.

Earlier this year a delegation of leaders from the business and economic development communities in the Tampa Bay area visited Germany to learn how that country's dual vocational and apprenticeship program successfully connects students at technical training facilities with job-creating companies. That delegation brought back some important lessons about helping the future Tampa Bay workforce compete in a global economy. If young Americans can simultaneously acquire job experience, technical training, and work ethic lessons while completing their education, it is my belief that the American economy will continue to prosper.

As a father of four sons who will soon be entering America's workforce, I am interested in exploring how we can help equip our younger generations with the necessary tools for success. I welcome thoughts from our panel today—thanks for being here—on how to provide students with the crucial technical skills and professional work experience at earlier stages in their education.

Thank you, Mr. Chairman, for holding the hearing, and I yield back.

Mr. LANCE. Thank you.

And I yield the balance of my time to Mr. Johnson of Ohio.

**OPENING STATEMENT OF HON. BILL JOHNSON, A  
REPRESENTATIVE IN CONGRESS FROM THE STATE OF OHIO**

Mr. JOHNSON. Thank you.

And, Mr. Chairman, thank you for holding this hearing as well.

I represent a region of Ohio, Appalachia, Ohio, that has been devastated with the loss of its manufacturing base. Steel industry has pretty much left, and of my 18 counties, 14 of them are in the top one-third of Ohio's highest unemployed counties in the State. So jobs and the economy are a big thing to the people that I represent.

There is a prosperity boom coming, though, with oil and natural gas, and trying to stay on the front side of that curve and provide the education that our young people need to prepare them for those kinds of jobs is a big challenge. So workforce development is huge. There is not a week that goes by that I am in my district that I don't get questions about how can my son or daughter prepare themselves for some of these oil and gas jobs. And as manufacturing begins to come back and take advantage of that nearly boundless source of energy, the opportunities are going to be there. I want to make sure my young people are ready to go.

So thank you, Mr. Chairman.

Mr. TERRY. Thank you.

I now recognize the gentleman from California for 5 minutes.

**OPENING STATEMENT OF HON. JERRY MCNERNEY, A REP-  
RESENTATIVE IN CONGRESS FROM THE STATE OF CALI-  
FORNIA**

Mr. MCNERNEY. Thank you, Mr. Chairman. I appreciate you holding this hearing today.

Mr. Johnson took away some of my fire here, but there is an interesting trend happening. Because of increasing production of oil and natural gas, manufacturing is beginning to move back to this country from other sources, from other places. That is a tremen-

dous opportunity for us, but if we don't have a skilled workforce, we are not going to be able to take full advantage of that opportunity.

Now, putting environmental concerns aside, we want—for the time being, we want to make sure that there is enough workforce out there. So your input is appreciated. The cooperation across the subcommittee and the full committee is appreciated.

And with that, I am going to yield to the ranking member.

Ms. SCHAKOWSKY. Thank you. Just a minute more.

I think, as the chairman alluded, I am sort of obsessed about this issue. But I also want to make an observation. You know, the hearings that we have in this committee and other subcommittees, often the room is full, and cameras are all over the place mainly documenting conflict, one side of the aisle and the other.

I happen to think that cameras ought to be loaded in this room; that this is where it is at for our country right now, that the kind of work that we are trying to do and to establish a framework of how government—how we—can be a partner to make our economy boom right now, and prepare our students, our American students, for the jobs of the century. And I hope as I said earlier that we can press forward with this kind of bipartisan effort to put it front and center. So I don't want to take any more time from our witnesses other than to just say how important I think your presence here today is and how important you are to our country. Thank you.

Mr. TERRY. I think all of us echo that. That was very good, Jan.

So at this point we are going to start our testimony from our grand witnesses here. We have Jennifer McNelly, president of the Manufacturing Institute; then next to her, Allyson Knox, director of education policy, and programs with Microsoft. Then we have Sandra Westlund—is it Deenihan?

Ms. WESTLUND-DEENIHAN. Yes.

Mr. TERRY. Chief executive officer, Quality Float Works Incorporated; Lazaro Lopez, that Jan mentioned in her opening statement. He is associate superintendent for teaching and learning, Township High School District 214, State of Illinois—not Illinois; Catherine Hill, Ph.D. director of research, American Association of University Women.

I thank all of you for being here and sharing your expertise and insight.

We give each witness 5 minutes. At 5 minutes, there's a sign up here that if it is a red light, I am going to start tapping the gavel, and that means sum up quickly.

So, and we will go from Miss McNelly—Nelly? Neilly?—

Ms. MCNELLY. Nelly.

Mr. TERRY [continuing]. To Dr. Hill.

And now you are recognized for your 5 minutes, Ms. McNelly.

**STATEMENTS OF JENNIFER MCNELLY, PRESIDENT, THE MANUFACTURING INSTITUTE; ALLYSON KNOX, DIRECTOR OF EDUCATION POLICY AND PROGRAMS, MICROSOFT CORPORATION; SANDRA WESTLUND-DEENIHAN, CHIEF EXECUTIVE OFFICER AND DESIGN ENGINEER, QUALITY FLOAT WORKS, INCORPORATED; LAZARO LOPEZ, ASSOCIATE SUPERINTENDENT, TOWNSHIP HIGH SCHOOL DISTRICT 214, STATE OF ILLINOIS; AND CATHERINE HILL, DIRECTOR OF RESEARCH, AMERICAN ASSOCIATION OF UNIVERSITY WOMEN**

**STATEMENT OF JENNIFER MCNELLY**

Ms. MCNELLY. Thank you, Chairman Terry, Ranking Member Schakowsky, Vice Chairman, and members of the committee. Thank you for the opportunity to testify today on behalf of The Manufacturing Institute, the national authority on the attraction, qualification, and development of world-class manufacturing talent, an affiliate of the National Association of Manufacturers.

Manufacturing remains an important economic force in regions across the country, but confronts a serious challenge: access to talent. In our most recent skills gap report, 82 percent of manufacturers report a moderate to serious shortage in skilled production labor. Today companies, especially smaller businesses with fewer training and HR resources, cannot afford the luxury of time-intensive training programs for their workers. They need employees who have knowledge and skills and can contribute right away.

The best way to address this challenge is to align education, economic, workforce, and business agendas. As representatives of the manufacturing industry, we found a solution that meets the needs of our businesses, while working within the existing secondary and postsecondary education structure.

Our solution, called the Skills Certification System, is a series of nationally portable, industry-recognized credentials based specifically on employer-identified skills. These credentials, used by companies across the country, clearly lay out a training required for a career in manufacturing.

However, success is not attained merely by designing a system; it must create results. In the past 2 years, we have helped to ensure that employers have access to over 173,000 individuals with the needed skills to enter into and advance in manufacturing careers. In our Return on Value survey, over 90 percent of the manufacturers using certifications believe they make a difference in validating the skills of their employees.

These outcomes are what we need to support and strengthen manufacturing and put individuals back to work, but we can't certify workers without a pipeline.

In addition to skill certification, we need to address the common misperceptions about manufacturing. While 7 out of 10 parents want manufacturing in their community, only 3 out of 10 want their children to be that manufacturer. We need to make manufacturing cool again.

On October 4th, over 800 of our Nation's manufacturers opened their doors on National Manufacturing Day and invited parents, students, teachers, and counselors in. One of those manufacturers

is T.R. Raimondo of Behlen Manufacturing in Columbus, Nebraska. Behlen is addressing the image issue by engaging its employees under the age of 30 as the voice of manufacturing to the next generation of job seekers. T.R. Is leading Dream It. Do It., a community-based network that aims to promote manufacturing as a top-tier career choice. With over half the country engaged in Dream It. Do It., the network is working to attract the next generation of workers.

The Manufacturing Institute is also targeting midcareer workers, including veterans and women, people like Daniel Brewer, a Cincinnati native who entered the Navy after graduation and received aviation electrical training. After deployment in Afghanistan, Daniel returned to civilian life with no formal job training and drifted from job to job. In February, Daniel joined the inaugural class of Get Skills to Work at Cincinnati State Technical and Community College and participated in a 4-week skill-certification program, ending as a certified production technician. Daniel's training and participation in Get Skills to Work led to employment with GE Aviation.

For many years, postsecondary success was defined as a 4-year degree, when, in fact, a valid industry-based credential can be the gateway to a well-paying job and a solid middle-class career. As a Nation, we need a new strategy for our manufacturing workforce grounded in industry standards with a new and renewed cooperation between industry, education, economic development, and the publicly funded workforce investment system. We need men, women, and children to view manufacturing as a top-tier career choice and have a path towards that career. Developing that path is good for manufacturing and good for the Nation.

Thank you for the opportunity to testify today. We look forward to working with you to build the next generation.

Mr. TERRY. Thank you.

[The prepared statement of Ms. McNelly follows:]



## Testimony

*of* Jennifer McNelly  
President  
The Manufacturing Institute

*before the* House Committee on Energy and Commerce  
Subcommittee on Commerce, Manufacturing, and Trade

*on* Our Nation of Builders: Training the Builders of the Future

November 15, 2013

COMMENTS OF THE MANUFACTURING INSTITUTE  
BEFORE THE  
HOUSE COMMITTEE ON ENERGY AND COMMERCE  
SUBCOMMITTEE ON COMMERCE, MANUFACTURING, AND TRADE

NOVEMBER 15, 2013

Chairman Terry, Ranking Member Schakowsky and members of the sub-committee, thank you for the opportunity to testify on behalf of The Manufacturing Institute at this hearing on "Our Nation of Builders: Training the Builders of the Future." My name is Jennifer McNelly, and I am the President of The Manufacturing Institute. We are the non-profit organization dedicated to improving and expanding manufacturing in the United States and an affiliate of the National Association of Manufacturers (NAM).

For over a generation now, the common perception has been that U.S. manufacturing is dying. So it comes as a shock to most people when you point out the actual facts:

- If it were its own country, U.S. manufacturing it would rank as the tenth-largest world economy;
- Every dollar in final sales of manufactured products supports \$1.48 in output from other sectors—this is the largest multiplier of any sector.
- Manufacturing supports an estimated 17.5 million jobs in the U.S.—about one in six private-sector jobs;
- In the fourth quarter of 2012, manufacturing employers paid \$33.52 per hour in wages and benefits, compared to other employers in the economy, which were paid about \$30.84 per hour; and
- Over 93 percent of all U.S. manufacturing firms employ less than 100 workers.

While manufacturing remains an important economic force in regions across the country, it now confronts some serious challenges, including:

- A significant increase in the structural costs facing the industry, caused by both worldwide demand for energy and raw materials and government policies on health care and tax rates;
- The absence of a coherent and coordinated national trade policy; and
- The lack of a national innovation strategy.

While these and other issues play out on the front pages of newspapers and websites, there is another challenge looming in the background, one that threatens not only manufacturers, but

also companies in every sector of the economy: the deteriorating condition of our workforce and, in particular, the next generation workforce.

In our most recent Skills Gap survey, incredibly, 82% of manufacturers report a moderate-to-serious shortage in skilled production labor.

The U.S. is betting its entire economic future on our ability to produce leading-edge products. Whether it's in IT, biotech, aerospace, construction...it doesn't matter. We'll be the ones to constantly create new and better things. This future promises to be bright, but only if we have the workforce capable of pushing that leading-edge. And right now, that doesn't look like a very good bet.

We have created an education system that is almost completely separate from the economy at large. Traditionally, it was the job of schools to educate children and create responsible citizens, and it was the job of companies to train employees. Jobs for individuals with almost any education level were plentiful because companies would spend the time and resources to turn them into productive employees. Today, companies, especially smaller businesses with fewer training and HR resources, cannot afford the luxury of time-intensive training programs for their workers. They need employees who have the knowledge and skills to contribute right away.

The only way to address this monumental challenge is to align education, economic development, workforce and business agendas so they work in concert to develop the talent necessary for business success in the global economy.

As representatives of the manufacturing industry, we think we've found a solution that fits the needs of our businesses while working within the existing secondary and postsecondary education structure.

Our solution, called the Skills Certification System, is grounded in a competency model developed by manufacturers to identify and document the basic set of skills required to work in any sector in the manufacturing industry.

In 2009, we joined with several other leading industry groups to create a system of nationally portable, industry-recognized credentials based on that competency model. These credentials—and the training required to obtain them—certify that an individual possesses those basic skills. We were also pleased to have the President of the United States highlight our system last year.

Our system can be envisioned as a pyramid of skills certifications, with an initial focus on the skills required for all entry-level jobs, identified as critical by the manufacturers themselves. Where our system takes the next step, though, is by organizing, aligning and translating those stackable credentials into corresponding educational courses that can be integrated into high-school and community-college degree programs of study. So, an individual can see that if he or she takes the following classes, he or she will have the skills to earn a nationally-portable, industry-recognized certification and be qualified to work in the following jobs at the following salaries.

While on its face, the idea of a skills certification system may not seem transformational, it is in fact reforming education, defining the outcome of success from completion to achievement of an industry standard. For too long, any programs that were "career and technical" or "company-specific" were pushed off into the non-credit side of academic institutions, making a loud and clear statement of the value that colleges and universities placed on those programs.

Our system is integrated into the for-credit side of colleges, so even if students take only three or four courses, achieve a certification and head into the workforce, they have “banked” those credits. When they return to achieve the next level certification, they will be working toward a degree as well. The achievement of degrees still holds meaning, both in the workplace and in society, and the education and skills that an individual obtains should be rewarded with advancement in education and in the economy.

This also creates more on and off ramps in education, which facilitates individuals’ ability to obtain schooling when their professional career requires it and also positions them to earn while they learn, applying what they learn in class at night on the job the next day.

For manufacturers we are applying the same rigors standards we use in our facilities to our most important supply chain, our human capital. Skills certifications nearly guarantee a level of quality in potential hires that does not exist today, greatly reducing the risk associated with hiring new employees—a risk that is more significant for smaller businesses that need to make targeted, skills-based hires without much room for error.

However, success is not attained merely by designing a system. It must create results. In the past 2 years, we have helped to ensure that employers have access to over 173,000 workers with the needed skills to enter into and advance in manufacturing careers. As my colleague and national champion Sandra Westlund-Deenihan just testified, the Skills Certification System has had a tremendously positive impact on her bottom line. In fact, in our Return on Value survey from October 2013, over 90% of manufacturers using the Skills Certification System believe they make a difference in validating the skills of their employees. Companies have seen positive impacts on training costs, employee retention, employee engagement, workplace safety and personnel decision-making.

We have created “The M-List,” a list that recognizes over 60 high schools, community colleges, technical schools, and universities that are teaching manufacturing students to industry standards. On October 4, 2013, national Manufacturing Day, I launched Jefferson Community and Technical College as the first M-List school in Kentucky.

These outcomes are what we need to support and continue our nation’s recovery and put individuals back to work.

But we can’t certify workers, without workers to certify.

In addition to skills certifications, we need to address common misperceptions about manufacturing in order to increase the number of individuals interested in manufacturing careers. While 7 out of 10 parents want manufacturing in their community, only 3 out of 10 encourage their children to be that manufacturer. We need to make manufacturing cool again, and make manufacturing careers a source of pride.

Tony Raimondo Sr. (T.R.), owner of Behlen Mfg. Co. in Columbus, Nebraska, is addressing this image issue by engaging former students of technical education programs to become the voice of manufacturing to the next generation of job seekers. T.R. is leading Dream It. Do It.™ in Nebraska, a community-based network that aims to promote manufacturing as a top tier career choice. With over half of the country engaged in Dream It. Do It., the network is working to attract and recruit the next generation of qualified manufacturing workers.

The Manufacturing Institute is also targeting mid-career workers, including veterans and women.

People like Daniel Brewer, a Cincinnati native who entered the Navy after graduation and received aviation electrical training. After deployment in Afghanistan, Daniel returned to civilian life with no formal job training and drifted from job to job. In February 2013, Daniel joined the inaugural class of the Get Skills to Work program at Cincinnati State Technical and Community College and participated in a four-week, skills-certification program. Daniel's training and participation in Get Skills to Work led to employment at GE Aviation, where he is a proud aviation technician.

Or workers like Karen Gilgenbach, a weld process specialist at Airgas USA, LLC in Milwaukee, Wisconsin. Karen entered the industry as a Sales Technician, but after earning certifications as a Certified Welding Supervisor and a Certified Robotic Arc Welding Technician, she was promoted to a technically focused role as a weld process specialist, Karen is one of only 23% of women in the manufacturing workforce. She was an honoree of the STEP Ahead awards in February 2013, and will be a mentor in the program for other women interested in manufacturing careers.

**Conclusion**

Mister Chairman, for many years, postsecondary success was defined as a four-year degree, when a valid, industry-based credential can be the gateway to a well-paying job and a solid middle-class career.

As a nation we need a new strategy for our manufacturing workforce, grounded in industry standards, with new and renewed cooperation with industry, education, economic development, and the public workforce investment system. We need policies that support this success. Policies like the America Works Act (HR497) will help advance these efforts.

We need men, women and children to view manufacturing as a top-tier career choice, and have a path towards that career. Developing that path is good for manufacturing and good for the nation.

Thank you for the opportunity to testify today. We look forward to working with you to build the next generation manufacturing workforce.

Mr. TERRY. Ms. Knox, you are recognized for 5 minutes.

**STATEMENT OF ALLYSON KNOX**

Ms. KNOX. Good morning, Chairman Terry, Ranking Member Schakowsky, and all the members of the subcommittee. Thank you for exploring the national skills gap and for inviting me to be a part of these hearings.

My name is Allyson Knox. For 10 years I worked in the fields of education, workforce development, and economic development in Michigan at the local, and regional and State levels. Nine years ago I began my work for Microsoft and currently serve as director of education policy and programs.

This morning I would like to focus on the skills gap facing this Nation, particularly in respect to computer science, ways in which Microsoft is addressing these challenges, and conclude with brief recommendations.

Each year for the next 10 years, this country will generate 120,000 jobs requiring a bachelor's degree in computer science, while at the same time our country graduated just 52,000 students with a bachelor's degree in computer science last year. This deficit of 70,000 degrees annually defines the challenge facing not only Microsoft, but all industries.

All companies are software companies. Think of it. In manufacturing we need people who can design and use simulations to improve products. In health care we need people who can explore vast quantities of data produced by DNA sequencing techniques. In the arts we need people who can design new special effects for movies.

Through numerous public-private partnerships, Microsoft is working to ensure that all students have the skills to compete in the global economy. There are three in particular that I would like to highlight for you this morning. First is our initiative to broaden access to computer science education at the high school level. Today only 8 percent of high schools in the U.S. offer AP computer science courses, and just 2 percent of all the AP exams taken last year were in this critical subject area. This is in part driven by the fact that only 15 States reward students who take computer science with a credit that will help them graduate from high school.

We are working with Governors and legislators across the country in order to expand the number of States that recognize the importance of computer science courses. At Microsoft we are also partnering with schools to help increase the number of students who take AP computer science exams through our TEALS program. "TEALS" stands for Technology Education and Literacy in Schools. TEALS places computer science professionals in the high school. TEALS volunteers to teach basic and Advanced Placement computer science courses with teachers. Today the TEALS program is operating in 70 schools in 12 States. This school year more than 280 volunteers will teach 3,000 students, and this model continues to grow very rapidly.

A second initiative called Partners in Learning supports all teachers as they help students integrate technology into their learning. This is a 15-year, \$750 million worldwide commitment. Over the last 10 years and in the United States, Microsoft invested \$50 million in specific Partners in Learning programs, such as the

Innovative Teachers program, the Partners in Learning Network, Innovative Schools, the Microsoft Innovative Educator program. We have reached 1 million U.S. teachers and students through this initiative.

The third initiative is called the Microsoft IT Academy program. This program ensures that students and adults can access technology certifications. ITA is designed to provide students and adults with college and career-ready technical skills, including network administration, databases, and collaboration skills. Its 250 courses are offered online, in person, or a hybrid version. Microsoft works directly with State government leaders to systematically deploy the ITA program to citizens throughout the State.

To conclude, there are three areas we hope Congress continues to focus on: number one, support teachers. Through our partnerships we see firsthand the dedication and determination of teachers striving to help their students be successful. And while we commend the States for aligning K–12 standards to skills necessary for college and careers, we recognize that teachers and schools need additional support.

Number two, help students complete postsecondary education. Our Nation must also address the fact that too few students enter STEM subjects in college, and of those who do, too few are successful in completing that degree. We need more of a national focus on helping students enter and complete these subject areas.

Number three, strengthen our Nation's job-training system. The fact that so many individuals are unemployed while employers simultaneously face such difficulty in finding the right skilled workers to fill a variety of high-paying jobs points to a skills mismatch that must also be addressed through better integrated technical career and job-training systems.

I have elaborated on these recommendations in my written testimony, and I would be happy to discuss them in more detail during questions and answers. Thank you again for the opportunity—

Mr. TERRY. Appreciate that.

Ms. KNOX [continuing]. To testify, and I look forward to your questions.

Mr. TERRY. Thank you, Ms. Knox.

[The prepared statement of Ms. Knox follows:]

STATEMENT OF ALLYSON KNOX  
DIRECTOR OF EDUCATION POLICY AND PROGRAMS  
MICROSOFT CORPORATION

BEFORE THE  
ENERGY AND COMMERCE COMMITTEE  
SUBCOMMITTEE ON COMMERCE, MANUFACTURING, AND TRADE  
UNITED STATES HOUSE OF REPRESENTATIVES

"OUR NATION OF BUILDERS: TRAINING THE BUILDERS OF THE FUTURE"

NOVEMBER 15, 2013

Thank you, Chairman Terry and Ranking Member Schakowsky, and all the Members of the Subcommittee for inviting me to testify today. My name is Allyson Knox and I am the Director of Education Policy and Programs at Microsoft Corporation.

As this subcommittee knows, the U.S. economy is challenged by a growing gap in STEM skills. I hear about this talent crisis every day as I travel across the country talking to educators and employers – they tell me they cannot find enough skilled workers to fill the jobs they have; even more telling they say this talent crisis is hindering their ability to add jobs into the future. Today, I will describe that skills gap from Microsoft’s perspective, highlight some of Microsoft’s public-private initiatives that focus on STEM skills development, and offer policy recommendations for the subcommittee’s consideration.

Like other employers with significant numbers of high skilled job openings around the country, Microsoft has been confronting the challenge of finding workers for our open jobs in a labor market where the necessary skills are in short supply. For example, WA State where Microsoft is headquartered has the fourth most STEM jobs in the country, yet its four-year colleges produce the fourth least STEM graduates. In an effort to address this challenge, Microsoft undertakes substantial recruiting activities at more than 150 universities in the U.S. and conducts targeted recruitment of experienced workers in the industry, including veterans and candidates with diverse backgrounds.

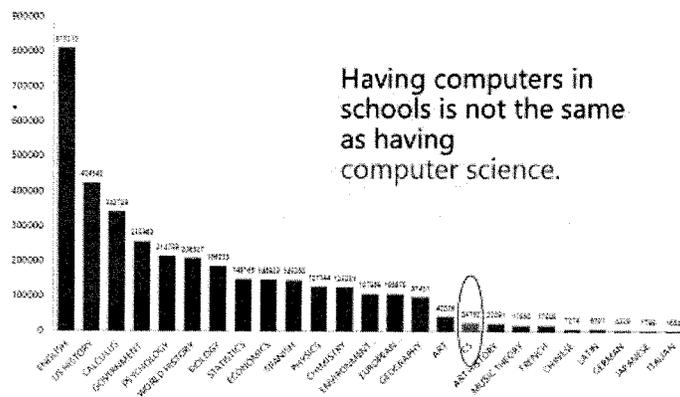
Despite these efforts, Microsoft currently has thousands of open positions in the U.S., many of which are for jobs in research, engineering, and development. Our experience at Microsoft is no different than the challenge being faced by employers with high skilled job openings around the country.

**Challenges of preparing Americans for the job opportunities of tomorrow.**

While companies are experiencing a national talent crisis, too many young people today are experiencing an opportunity divide between the training they have and the skills they need to succeed. This growing challenge is the result of our education system not keeping pace with the changing needs of the workplace, especially in the computer science and other high demand STEM fields. Our K-12

educational system is not producing enough high school graduates with sufficient preparation for success in college. In 2011, only 45 percent of U.S. high school graduates were prepared for college-level math, and only 30 percent were prepared for college-level science. More recently, last week's results of the National Assessment for Educational Progress (NAEP) showed that despite positive trends, only 36 percent of our 8<sup>th</sup> graders are proficient or advanced in mathematics. Our students are also scoring significantly lower in math and science literacy compared to their counterparts in other developed countries.

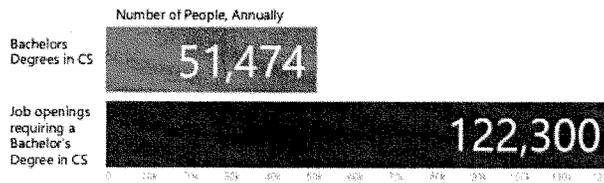
### 2012 AP Test Snapshot



The lack of emphasis on computer science in high school is a particularly acute concern as our nation seeks to keep pace with our global competitors. Of the more than 42,000 high schools in the U.S., only 3,249 were certified to teach the Advanced Placement (AP) computer science course in 2013. That's fewer than 10 percent. Looking at this from a different angle, we know that introductory secondary school computer science courses have decreased in number by 17 percent since 2005 and the number

of AP Computer Science courses has similarly decreased by 33 percent. The bottom line is that computer science courses in K-12 education are disappearing from the national landscape at the very time they are needed most, given the skills requirements of employers to secure these high paying IT jobs.

## Our Computer Science Shortage Supply is not meeting demand



The pipeline of talent is restricted within the higher education system as well. The Bureau of Labor Statistics has projected that there will be approximately 122,300 new job openings in the U.S. each year in computing occupations requiring at least a bachelor's degree through the end of this decade. Yet nationally, our universities are producing just over 50,000 bachelor's degrees in computer science each year.

Our colleges and universities simply do not have the capacity to meet the demand for educating and graduating students with degrees in key STEM majors. The Seattle metropolitan area is home to one of the top computer science departments in the U.S. at the University of Washington. Yet, that department turns away 75 percent of students at the university who complete the prerequisites and apply for the major simply because it doesn't have the faculty or space to educate them, despite the demand for engineers graduating from the department. Currently, the program has the capacity to graduate a mere

200 students—at the bachelor’s, master’s and doctoral levels combined—each year. This is just one example of a leading university that still can’t meet the demand of the number of students who want to major in computer science. We need to do better.

#### **Addressing the Skills Gap through Public-Private Partnerships**

In order to meet our current employment demands – collaboration and partnerships become critical. Microsoft partners directly with schools, community and four-year colleges, non-profit organizations and governments at the local, state, and federal levels to try to achieve a larger impact with our initiatives. We believe these partnerships become even more essential in an era of reduced government spending.

In fact, Microsoft takes partnership development, expansion, and management seriously. Many Microsoft employees earn a “Partnership Brokers Training Certification” from the Partners Brokers Association to gain the skills needed to design, facilitate, and manage public-private partnerships. This five-day training program helps employees recognize the unique assets of public partners, establish mutually beneficial goals, speak in multiple languages, and drive for results in a complex context. Many of our “partner certified” Microsoft employees manage large public-private skills training programs within Microsoft. Examples include: Microsoft’s Corporate Citizenship program called YouthSpark; Microsoft Learning’s program called IT Academy; and Microsoft Education’s program called Partners in Learning. The majority of Microsoft’s public-private partnerships are designed to help drive employability, digital literacy, technical and STEM-focused training and certification, and 21st-century workforce development for high school, community college, and college students.

A clear example of this work is Microsoft’s YouthSpark ([www.microsoft.com/Youthspark](http://www.microsoft.com/Youthspark)) initiative. One year ago, Microsoft announced YouthSpark, a company-wide initiative to empower youth to imagine and realize their full potential by connecting them with greater opportunities for education, employment, and entrepreneurship. Through more than 30 programs and partnerships with youth-

servicing nonprofits, in its first year alone Microsoft YouthSpark has created opportunities for more than 103 million young people in over 100 countries around the world. Here in the U.S., we partner with five major nonprofit organizations with missions to give youth the skills, education, and job training they need to succeed. Our national partners include The Boys & Girls Clubs of America, City Year, Junior Achievement USA (JA), Network for Teaching Entrepreneurship (NFTE), and Year Up. We also partner with the CityBridge Foundation and the College Success Foundation in Washington, DC.

On the surface, the national partners aim to bolster programs that help youth learn important 21st-century skills, find jobs, and connect with caring adult mentors. Beneath the surface, however, are thousands of stories of real young people who have been impacted by these programs, gotten off the streets, found their dream jobs or been inspired to further their education.

Although there is still more to do, we have been inspired by the results. Across the country, young people are taking the lead in gaining the skills they need to succeed while making a real impact in their communities. These stories include young mothers who have gained the skills they need to support their children, underperforming youth who experienced math “clicking” for the first time, young entrepreneurs who have created their own innovative businesses, and many more. Here is one of many U.S. YouthSpark stories of success:

**Anthony Halmon:** In his younger years, Halmon felt a lot of pressure to become involved in gang-related activities. His life changed forever the year his father passed away and his daughter was born. Determined to take a different path, Halmon enrolled in the Perspectives Leadership Academy in Chicago and his grade point average skyrocketed from a 1.0 to 3.6. During his junior year, he became involved with the Network for Teaching Entrepreneurship and designed the thermofier – a pacifier with a built-in thermometer, inspired by his infant daughter. He presented his invention at the White House Science Fair, where he met President

Obama. Now, Halmon is a freshman at Cornell University, where he says he may pursue civil engineering. He wants to speak to upcoming generations and inspire them with his story.

In addition to partnering with skills-focused, national non-profits operating in communities around the country, Microsoft also engages in successful public-private partnerships to help solve the opportunity divide and provide youth with the skills they need to succeed. To help today's students obtain high-tech skills, Microsoft's TEALS (Technology Education and Literacy in Schools) program places computer science professionals in high schools. Working side-by-side with in-service teachers, TEALS volunteers teach basic and Advanced Placement (AP) computer science courses.

The TEALS program brings together computer science engineers from across the tech industry and uses the team-teaching model to promote self-sustaining computer science programs in their high schools.

The program began with one Microsoft employee who recognized need for computer science courses in high schools and started volunteer teaching AP computer science in one Seattle high school three years ago. He worked closely with Seattle school district leaders to learn how an urban school district operates, manages volunteers, and integrates professionals into classrooms. After further feedback, many discussions, and students passing the AP computer science exam - the employee recruited more software engineer volunteers into additional Seattle classrooms. He presented the success to Microsoft and now this employee manages TEALS as a full time job.

Today the TEALS program is operating at 70 schools in 12 states (AK, CA, DC, KY, MA, MN, NC, ND, NY, UT, VA, and WA). Currently, more than 280 volunteers will teach 3,000 students during the 2013-2014 school year alone. With the demand for TEALS continuing to grow, this partnership is making a positive impact in schools across the country, as evidenced by the story of an important difference in a Lee County, Kentucky student.

**Jeremy Moore:** Jeremy never thought he would go to college. The struggling economy in his rural Kentucky hometown provided Jeremy with few opportunities. But, he always loved

technology, even without formal instruction. “He learned what he could on his own, but didn’t really know where to go from there,” says Tammy Moore, Jeremy’s mother. Jeremy now learns about computers and computer programming every day. “TEALS has been a godsend to us,” says William Owens, Lee County Board of Education chairman. “We couldn’t afford the teachers and the program, so Microsoft stepped in — and we are very grateful.” The program has been a huge success so far. “We wanted to see if we could take the successes we had locally and make a national impact,” says Microsoft Software Engineer Isaac Wilson, who teaches Jeremy remotely from Redmond, Washington. More important, Jeremy made the honor roll for the first time ever in the 2012–2013 school year, and hopes to attend college and fulfill his dream of becoming a software engineer. “TEALS helped him all around,” says Tammy. “The sky’s the limit for him now.”

TEALS is the programmatic demonstration of Microsoft’s commitment to broadening access to computer science education. We are also committed to supporting programs that motivate students to take computer science courses. By partnering with national non-profit organizations like the Computer Science Teachers Association (CSTA) and Code.org, Microsoft is working to ensure more students are have the opportunity and are incentivized to take a computer science course at the high school level. In more than 30 states, when a student completes a computer science, course they only receive an “elective” credit, none of which help them fulfill their high school graduation requirements<sup>1</sup>. When competencies such as algorithmic problem-solving, data analysis, and modeling real-world problems are taught in a computer science course – that course should also be able to be counted as a math or science credit. By counting it as a math or science credit – students have more of an incentive to take computer science classes.

Microsoft and its partners are working closely with state policymakers in more than 15 states to increase the number of states that count computer science as a math or science credit toward high

school graduation requirements. This policy and advocacy effort demonstrates Microsoft's two-pronged approach to ensuring all students have the education and skills they need to compete in the global economy.

Microsoft also supports public-private partnerships at the state level through its IT Academy (ITA) ([www.microsoft.com/itacademy](http://www.microsoft.com/itacademy)) program. ITA is designed to provide students with college and career-ready technology skills on a range of industry programs including network administration, collaboration tools, spreadsheets, databases, word processing, presentation tools, programming, etc. Built with a series of online learning courses and modules mapped to industry demand certifications, courses cover a range of technologies and subject areas, including Microsoft Office, applications development, database management, and network and systems administration with Windows Server. In total, ITA offers more than 250 courses.

Microsoft works directly with state government leaders to systematically deploy the ITA program to students throughout the state. By working with state departments of education and state education associations, an increasing number of educators, principals, and local superintendents become aware of the ITA opportunity and are trained in how to infuse it into classrooms. This systemic approach increases program efficiencies, reduces costs, and increases ITA access for urban, rural, and suburban students.

Microsoft's IT Academy program is a leading U.S. education program for secondary and higher education students that boost technology skills and help connect learning with potential careers, providing schools with official learning content, online courses, digital books, software licenses, lesson plans, quizzes, and teacher prep resources to help students realize their potential and pursue industry-recognized certifications. In recent years, IT Academy partnerships have expanded to include libraries and workforce development initiatives as well as to help meet the growing needs associated with the transitioning adult learner community. IT Academy emphasizes industry certification attainment as a

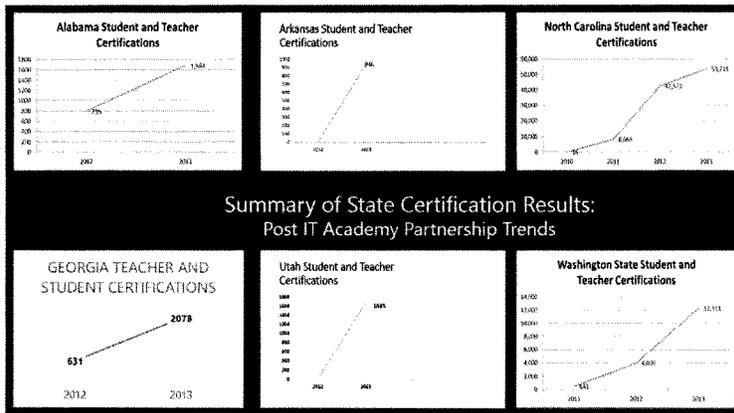
benchmark for achievement, giving all students the opportunity to earn one of several industry-recognized credentials. The most common certification earned at the high school level is the globally-recognized Microsoft Office Specialist (MOS) certification.

A student can be certified on any single Microsoft Office application to be Microsoft certified (e.g., MOS Excel). Microsoft works with state leaders to ensure that IT Academy program helps not only help students gain certifications but their teachers can become certified as well. Currently these skills-focused partnerships are operating in the following states:

State	Organization	Number of Microsoft IT Academies
Arkansas	High Schools and Workforce Agencies	343
Alabama	High Schools	132
Delaware	High Schools	36
District of Columbia	High Schools	30
Georgia	High Schools	463
Hawaii	State Public Library System	52
Iowa	STEM Schools	150
Louisiana	High Schools	307
Nebraska	Universities/Community Colleges	3
New York	Universities/Community Colleges	25
North Carolina	High Schools	628

	Community Colleges	58
Utah	High Schools	150
Virginia	High Schools	321
Washington	High Schools	702
	Library Branches	400

The following charts indicate examples of explosive student and teacher certification attainment growth in some of these states:



One of Microsoft IT Academy's best practices is North Carolina. North Carolina was the first state to adopt ITA and since August 2009 has certified approximately 100,000 students and teachers in Microsoft Office Specialist.

**MS ITA Best Practice  
NORTH CAROLINA STATE-WIDE ADOPTION**

	<b>Pre-IT Academy</b> (Aug 2009- June 2010)	<b>1<sup>st</sup> Year of IT Academy</b> (Aug 2010- June 2011)	<b>2<sup>nd</sup> Year of IT Academy</b> (Aug 2011- June 2012)	<b>3<sup>rd</sup> Year of IT Academy</b> (Aug 2012- June 2013)
<b>Number of total MOS certifications</b>	21	8,794	43,630	53,731
<b>Number of student MOS certifications</b>	16	8,065	42,563	52,922
<b>Number of teacher MOS certificates</b>	5	729	1,148	809

Microsoft Office Specialist (MOS) certifications through the Microsoft IT Academy across North Carolina's public high schools

Statewide public-private partnerships focused on building 21<sup>st</sup> century skills are also created through Microsoft's U.S. Partners in Learning (PiL) initiative ([www.microsoft.com/partnersinlearning](http://www.microsoft.com/partnersinlearning)). Partners in Learning's goal is to strengthen students' 21<sup>st</sup> century competencies by infusing technology into their regular classroom learning. Microsoft is committed to training teachers and school leaders to effectively use technology in learning. This is a 15-year, \$750 million worldwide commitment. Over the last ten years and in the United States, Microsoft invested \$50 million dollars in specific PiL programs such as the Innovative Teachers Program, Partners in Learning Network, Innovative Schools, and the Microsoft Innovative Educator Program. We have reached 1 million U.S. teachers and student through this initiative.

As one example, U.S. PiL is in the early stages of partnering with Omaha Public Schools by working closely with one of its outstanding educators – Maddie Fennell. Maddie Fennell is an Omaha Public Schools Literacy Coach at Miller Park Elementary School, an inner-city school in Omaha, Nebraska. She has taught for 24 years in Omaha Public Schools, was named 2007 Nebraska Teacher of the Year, and is

currently serving as a U.S. Department of Education Teaching Ambassador Fellow. After learning about and meeting with U.S. PiL leaders, she is committed to bringing PiL's robust technology in education offerings to the district to achieve transformational learning. She has worked with her district to inform all 3,000 Omaha Public School teachers about the Partners in Learning Network which provides all teachers online professional development, self-assessments, and lesson plans for free.

Recognizing the need to help great teaching candidates find jobs in the classroom, Microsoft is also partnering with a coalition of public, private, and government leaders to support a new website called TEACH.ORG. This website features a wide variety of resources ranging from detailed information on how to find student aid, to link, for job opportunities in schools throughout the country. Each PiL program furthers educator professional development, highlights exemplary practices, fosters greater educator collaboration, and provides access to online learning communities.

A particularly successful Partners in Learning statewide partnership focused on helping students gain career planning and online learning skills continues today. In 2008, Michigan education leaders and students struggled to meet the state's new high school graduation requirement that was to complete twenty hours of online learning. CareerForward, a 20-hour online course designed to meet the new requirement for free, was created by MVU® through substantial partnership support from both Microsoft Partners in Learning and the Michigan Department of Education.

The course helps students plan their work lives and career opportunities amid the implications of the global economy. It teaches students about the global economy, why finishing high school is important, why gaining technical skills is important, how to manage their personal finances, and how to become a young entrepreneur. As a result of major investments by Microsoft's Partners in Learning program and MVU, CareerForward is available to all secondary students at no cost, and other states offer the course to their students to help them meet online learning requirements and gain course competencies.

Microsoft also engages in public-private partnerships in key cities to help students build new and important 21<sup>st</sup> century competencies. For example, Microsoft is partnering with four other technology companies, Chicago Public Schools, the City Colleges of Chicago (CCC), and Chicago Mayor Rahm Emanuel to expand the P-Tech model in Chicago. The P-Tech model, developed by IBM, provides students with the opportunity to attend an Early College STEM School that focuses on technology skills and career readiness – as well as earn college credits. Companies are paired with specific high schools while also remaining connected with the larger Chicago P-Tech network.

Microsoft's primary partner school is Lake View High School where each student will be able to graduate in four-years with a high school diploma with college credits, with a goal of graduating within six years with an Associate of Science (AS) degree in computer science or an Associate in Applied Science (AAS) in Information Technology. In addition, each school solicits auxiliary partners to offer tutoring and college guidance to ensure high graduation and college completion rates and receives technology infrastructure to support the program as well as targeted professional development. Upon graduating from the programs and schools, students are prepared for careers in science and technology.

Every day Microsoft partners with local education and non-profit organizations to help ensure all students access technology and 21<sup>st</sup> century skill development opportunities. For younger students, Microsoft offers fun coding experiences through competitions like KoduKup. Kodu is a visual programming language made specifically for creating games. For high school minority students – Microsoft manages DigiGirlz programs where minority girls gain the opportunity to learn about careers in technology, connect with Microsoft employees, and participate in hands-on computer and technology workshops.

For older students, Microsoft helps match students' skills with the needs of local businesses through its Students to Business (S2B) program. Older high school students and students pursuing post-secondary

degrees can experiment with coding and game design by downloading professional Microsoft developer, designer, and gaming software at no charge or compete in Imagine Cup.

Imagine Cup ([www.microsoft.com/imaginecup](http://www.microsoft.com/imaginecup)) is the world's most prestigious student technology competition, bringing together 300,000 student innovators from all over the world. With Microsoft resources and support, students bring their ideas for new apps, games, and social entrepreneurship to life. All of these student-focused programs can only be successful when Microsoft effectively partners with the organizations where students are already engaged and learning and supported by a mentor or teacher or leader.

Microsoft's most recent public-private partnership – the Microsoft Software and Systems Academy – was unveiled just this month, on November 4. The program is designed to provide software development training and testing to U.S. active duty service members transitioning out of the military and aims to offer America's veterans the opportunity for new careers in the growing technology field. The Academy consists of a 16-week course to prepare U.S. service members to obtain the certification required for technology careers such as a developer, applications engineer, and IT project manager. Beginning as a pilot program with Saint Martin's University at Joint Base Lewis-McChord in Washington state — the largest military installation west of the Mississippi — the program will be available later this year on key bases in California and Texas, with additional locations to be announced in coming months. Active duty service members transitioning from all branches of the military as well as members of the National Guard and Reserves returning to their civilian jobs are eligible for the academy. In addition to receiving a Microsoft IT Academy-powered curriculum provided by Saint Martin's University, service members who complete the pilot program will be hired into entry-level roles as software testers by either Microsoft or Launch Consulting, the technology consulting firm administering the program.

**Recommendations:**

Based in part on the insight and experience we have gained through our support of the initiatives described above, we believe there are several areas where Congress can strengthen our nation's STEM pipeline. These include: supporting great teachers; expanding access to STEM courses; promoting college completion; and strengthening our nation's job training system.

Supporting Great Teachers: Through our partnerships, we see firsthand the dedication and determination of teachers striving to help their students be successful. And, while we commend the states for aligning K12 standards to college and career, we recognize that teachers and schools need additional supports to implement these more rigorous standards. To help support teachers in the classroom, we must ensure federal programs address key issues such as the adequate preparation of teachers so they have the knowledge and ability to be successful as soon as they begin their teaching career. These programs must also provide flexibility for schools and districts and allow for innovative ways to recruit teachers, especially in shortage areas such as those related to the STEM subjects. In addition, it is critical that the significant investments being made at the federal level for professional development are used in ways that leverage innovative partnerships and strategies that have a proven record of success and which respond to the needs of teachers in the classroom.

Expanding STEM Courses: Too few students have access to high quality STEM courses. While the proliferation of STEM education programs at the Federal government has been well documented, the reality is that many "authorized" programs are not funded. This is particularly true for programs that have historically provided assistance directly to schools to support programs related to technology and science in the classroom. We would encourage members of this Subcommittee to support those federal programs that focus on expanding access to STEM education courses, including computer science in high school.

College Access and Completion: Our nation must also address the fact that too few students enter STEM subjects in college and of those who do, too few are successful in completing their degree. As part of the upcoming reauthorization of the Higher Education Act (HEA), Congress has the opportunity to address these issues through a variety of strategies including: increasing the capacity for community colleges and universities to offer more STEM degree opportunities; promoting college completion by making degree programs easier for students to navigate from start to finish; and incentivizing colleges to focus on other strategies to improve completion rates and ensure transparency.

Strengthening our Nation's Job Training System: The fact that so many individuals are unemployed while employers simultaneously face such difficulty in finding the right skilled workers to fill a variety of high paying jobs points to a skills mismatch that must also be addressed through better integrated technical career and job training systems. The current system of job training through both Career and Technical Education and the Workforce Investment Act (WIA) are long overdue for major overhauls to ensure more economically disadvantaged adults and dislocated workers have access to high quality training programs that reflect the realities of the skills that are needed in the workplace. Here too, we look forward to working with Congress as efforts are underway in both the House and Senate to update and reform these laws.

Again, thank you for the opportunity to testify today. I look forward to answering your questions

---

15 States that Count Computer Science Toward  
H.S. Graduation Requirements

1	District of Columbia	Math	
2	Georgia		Science
3	Indiana	Math	
4	Michigan	Math	
5	Missouri	Math	
6	North Carolina	Math	
7	Oklahoma	Math	
8	Oregon	Math	Science
9	Rhode Island	Math	Science
10	Tennessee	Math	
11	Texas	Math	Other
12	Utah	Math	
13	Vermont	Math	
14	Virginia	Math	Science
15	Washington	Math	Science

Source: [Computing in the Core](#)

---

**Summary—Testimony of Allyson Knox, Director of Education Policy and Programs at Microsoft**

Allyson Knox will testify about the STEM skills gap from Microsoft's perspective, highlight some of Microsoft's public private initiatives that focus on STEM skills development, and offer policy recommendations for the subcommittee's consideration. While companies are experiencing a national talent crisis, too many young people today are experiencing an opportunity divide between the training they have and the skills they need to succeed. In order to meet our current employment demands – collaboration and partnerships become critical. Microsoft partners directly with schools, community and four year colleges, non-profit organizations and governments at the local, state, and federal levels to try to achieve a larger impact with its' initiatives. Examples of Microsoft public-private programs include: Microsoft's Corporate Citizenship program called YouthSpark; Microsoft Learning's program called IT Academy; Microsoft's TEALS (Technology Education and Literacy in Schools) program; and Microsoft Education's program called Partners in Learning.

Microsoft also engages in public-private partnerships in key cities to help students build new and important 21st century competencies. In addition, Microsoft partners with local education and non-profit organizations to help ensure all students access technology and 21st century skill development opportunities. Microsoft works to provide hands-on learning opportunities for students and to actively engage traditionally underrepresented populations in STEM field, including girls and minorities.

**Recommendations:**

Based in part on the insight and experience Microsoft has gained through support of the initiatives described above, Microsoft believes there are several areas where Congress can strengthen our nation's STEM pipeline. These include: supporting great teachers; expanding access to STEM courses; promoting college completion; and strengthening our nation's job training system.

Mr. TERRY. Ms. Westlund-Deenihan, you are now recognized for your 5 minutes.

**STATEMENT OF SANDRA WESTLUND-DEENIHAN**

Ms. WESTLUND-DEENIHAN. Thank you, Chairman Terry, Ranking Member Schakowsky, and distinguished members of the committee. Thank you for the opportunity to appear today to testify on behalf of Quality Float Works Incorporated at our hearing on “Our Nation of Builders: Training the Builders of the Future.” My name is Sandra Westlund-Deenihan, and I am the CEO and design engineer of Quality Float Works Incorporated, the premier manufacturer of floats and assemblies used in gas, oil, plumbing, and agricultural applications across the globe.

In 1915, my grandfather started a manufacturing company out of his home on the southwest side of Chicago. Today, more than 98 years later, our company remains a third- and fourth-generation, family-owned-and-operated business. I run the company, and my son works with me, Jason Speer.

Our company currently exports its products to such locations including Europe, Asia, Australia, and several locations throughout Latin America and the Middle East. In fact, in 2013, we were honored by the U.S. Small Business Association as Illinois’ Small Business Exporter of the Year. And I am happy to report that due to our efforts, to diversifying and expanding globally, Quality Float Works is thriving. Overall sales have increased roughly 200 percent over the past decade, with international sales skyrocketing from 3 percent to 37 percent of our business.

So “Quality” isn’t just in our name, it is also in our product. Our floats are engineered to the most exacting standards and built with the know-how of skilled craftsmen. Moreover, we custom-design many floats and have a built—a best-in-class reputation among customers and the industry.

To maintain this level of quality, we need a workforce with the skills and the knowledge to understand precision instrumentation and production. Our customers demand and expect precision manufacturing, and precision manufacturing requires a basic knowledge of STEM competencies, science, technology, education, and math, yes, even for the entry-level worker. It always amazes me how many times I have had to teach a member of my team how to use a ruler, utilize fractions and decimals, and if I didn’t have a digital clock on the wall, they might not know how to tell time.

The skills gap is real and poses a serious economic threat to American competitiveness. The bottom line is if we as employers cannot find qualified applicants for jobs, it impacts our business and our profitability.

Please understand, this is not just about educating students to fill our positions; it is also about making sure our children have the opportunity and the tools to get a quality education, a good, high-paying job, and the ability to achieve their dreams and to become self-sufficient. Unless we and the industry leaders engage ourself personally in the solution, nothing is going to change.

It would be easy for me as the CEO of a company to complain about the quality of the applicants, blame the education system, and put the onus on someone else to fix it, but I know that is not

going to change anything. We need to find solutions that get results, both short and long term. We need to partner with our schools to create a system that meets the immediate needs of employers today, adequately trains and prepares the workforce of the next 5 to 10 years, establish a solid educational foundation for our children, and mentor young people on the benefits of manufacturing and STEM careers.

It is for this reason I am excited to be serving on the newly created National Association of Manufacturing Board of Directors Task Force on Competitiveness and the Workforce. Our mission is to take a serious look on the workforce problems, skills gap, and STEM education programs across the country. And I am proud to be working with the NAM on this effort, as the organization is truly committed to the success in this area.

Modern manufacturing is no longer a dirty job, but as a leader in the industry, we need to get our hands dirty to fix the skills gap problem. Industry-recognized credentials and mentoring, business leaders need to get engaged with educators. Those are two approaches that are working for me in Illinois. Quality Float Works may be a small business, but we are determined to make a large impact by changing our education and skills pipelines to create more opportunities for the next generation of the United States workforce.

Thank you very much.

Mr. TERRY. Thank you.

[The prepared statement of Ms. Westlund-Deenihan follows:]

Quality Float Works, Inc.

## **Testimony**

**Sandra Westlund-Deenihan**

**CEO and Design Engineer  
Quality Float Works, Inc.**

**Before the**

**Commerce, Manufacturing and Trade Subcommittee  
of the Energy and Commerce Committee**

***on "Our Nation of Builders: Training the Builders of the Future"***

**November 15, 2013**

COMMENTS OF QUALITY FLOAT WORKS, INC.  
BEFORE THE  
COMMERCE, MANUFACTURING AND TRADE SUBCOMMITTEE  
OF THE ENERGY AND COMMERCE COMMITTEE  
NOVEMBER 15, 2013

Chairman Terry, Ranking Member Schakowsky and distinguished members of the committee, thank you for the opportunity to appear today to testify on behalf of Quality Float Works, Inc., at this hearing on "Our Nation of Builders: Training the Builders of the Future."

My name is Sandra Westlund-Deenihan, and I am the CEO and design engineer of Quality Float Works, Inc., located in suburban Chicago.

In 1915, my grandfather started a manufacturing company out of his home on the southwest side of Chicago. A metal spinner by trade, he used his expertise to make hollow metal float balls used to level liquid controls. Today, more than 98 years later, our company has become the premier manufacturer of floats and assemblies used in gas, oil, plumbing and agricultural applications across the globe. Quality Float Works, Inc., remains a third-and fourth-generation family-owned and operated business—I run the company with my son, Jason Speer.

In 2003, through entrepreneurial diversification efforts, Quality Float Works, Inc., made a historic shift by diversifying its product line with the launch of our Quality Float Valve Division. Float valve assemblies are mainly used to purify and desalinate water, among other applications, in developing nations. The company currently exports products to locations including Australia, Belgium, Canada, China, Germany, Indonesia, Ireland, Kuwait, Mexico, Nigeria, Oman, Kingdom of Saudi Arabia, Singapore, Vietnam and several locations throughout the United Kingdom and Latin America.

In 2011, Quality Float Middle East, our first international distribution center, launched in Dubai, UAE (United Arab Emirates) and we are looking to the Gulf Cooperation Council (Middle East, Gulf Countries) to fuel future growth while also exploring business in Panama, Chile and Africa. In fact, in 2013, the U.S. Small Business Association honored us with the Illinois Small Business Exporter of the Year award. We have weathered the recent economic storm by expanding our reach abroad and entering untapped markets that can benefit from U.S. products.

I am happy to report that due to our efforts to diversify and expand globally, Quality Float Works is thriving. Overall sales have increased roughly 200 percent over the past decade with international sales skyrocketing from 3 percent to 37 percent of total receipts.

Quality isn't just in our name, but it's also in our products. Our floats are engineered to the most exacting standards and built with the know-how of skilled craftsmen. Moreover, we custom-design many floats and have built a best-in-class reputation among customers and the industry. To maintain this level of quality, we need a workforce with the skills and knowledge to understand precision instrumentation and production.

The skills gap is an ever-present issue for my company. With approximately 25 employees at our Chicago facility, every open position represents a significant challenge to production and hinders potential growth opportunities. At one point last year, I had three machinist job openings available for more than 10 months. Some quick math will tell you this translates to more than 10 percent of my workforce. Not having the talent I need available results in consequences to the business. Quality Float Works has enough business right now to merit hiring a second shift, but I am unable to find enough people with the basic skills necessary to manufacture a quality product.

Our customers demand and expect precision manufacturing, and precision manufacturing requires a basic knowledge of science, technology, engineering and mathematics (STEM) competencies—even for entry-level line workers. For example, some of our products are used in oil and gas separators. The floats are used in a trunion, which separates the oil from water. The float sits in the middle of the structure, so if it malfunctions, replacement takes many hours, which equates to downtime and other potential liabilities for our company. This impacts everyone's bottom line. One of the challenges I face as an employer is recruiting a workforce with basic STEM competencies. It always amazes me how many times I've had to teach a member of my team how to use a ruler, utilize fractions and decimals – or even how to tell time on a non-digital clock.

We also see a significant skills gap in the areas of welding and machining. I cannot simply hire someone who knows how to weld. I need someone who understands the science of welding—the temperature of the heat, cleanliness of the metal, speed, correct electrodes and the proper gas can all affect the outcome of the weld. A condition called porosity could exist if the welder does not fine-tune the right combinations of the elements for the job. The consequences yield corrosion, allowing leaks to occur in the float. This again is a liability issue involving damage to equipment, liquids spilled and potential personnel involvement. Some of our floats are used on aircraft carriers and ships to keep water off the decks of the carrier. If the float malfunctions, water on the deck of a carrier could put the life of a pilot at risk. To ensure my team is best equipped to prevent these production hazards, I need them armed with a deep level of knowledge, such as an American Welding Society Credential, a manufacturing industry-recognized credential that provides a consistent profile for the skills of a potential employee. Credentialing ensures – the science is there; the knowledge is there. Credentialed employees provide an immediate benefit the moment they join my team.

That is why I support the America Works Act, which prioritizes industry-recognized credentials such as WIA, TAA and Perkins.

It would be easy for me, as the CEO of a company, to complain about the quality of applicants, blame the education system and put the onus on someone else to fix it, but I know that's not going to change anything. We need to find solutions that get results—both short and long term.

Through all of the work I have done at both the state and national levels, I have realized we are often leaving talent "on the table" and walking away from potential workers by making judgments about students too early in the educational pipeline. I believe mentoring is essential to success. One of my best employees was someone I met through a school-to-work program we're involved with through a relationship we've developed with a local high school. His parents had given up on him. He had been fired for not showing up at his last job and was fast approaching the same fate in the fast-food position he was trying to maintain. I asked one question: "Does he like to work with his hands?" He did, so we brought him onboard through the work-study program and nurtured his learning process. He graduated from high school in 2009, earning several A's his senior year. He has a career path, earned an apprenticeship and received his certification in MIG and TIG welding—continuing his work for Quality Float Works as a certified welder. Nontraditional learners are often ideal candidates for the types of jobs we need to fill, and I believe it takes the involvement of business leaders, and a partnership with our educational system, to recognize and take advantage of those opportunities when they arise.

When it comes to STEM-related careers, women may be, perhaps, our most underutilized resource. In the past 20 years, the rate of women in engineering has increased only 3 percentage points, still putting us below 20 percent of total graduates in the field. We are leaving half of the nation's intellectual capital untapped. This is unacceptable, especially when you consider that the United States is trailing the world on producing scientists and engineers.

As Chair of the Illinois State Board of Education's Gender Equity Advisory Committee and board member of the National Alliance for Partnerships in Equity Education Foundation (NAPE-EF), I have supported and advocated for a public/private partnership to increase underrepresented populations in advanced secondary STEM classes. For the past three years, I have worked with NAPE-EF in collaboration with my local school district to secure funding through a grant program sponsored by Motorola Solutions Foundation's Innovation Generation program. Our public/private partnership was awarded \$50,000 to fund the STEM Equity Pipeline – a program to engage administrators, counselors and faculty from five area high schools in intensive professional development to increase access, success and post-secondary transition of girls and other underrepresented groups in STEM. We have had great success in our first few years—results show a significant increase in advanced placement (AP) STEM testing and an increase of females enrolling in AP chemistry and math. Technical education enrollment also rose heading into this last school year as well as overall interest in nontraditional STEM-related careers after graduation. As a female engineer,

it is a passion of mine to be a role model for our young women—our next generation of engineers and manufacturers.

For all these reasons, I am thrilled to be serving on the newly created National Association of Manufacturers (NAM) Board of Directors–level Task Force on Competitiveness & the Workforce. Announced in October and chaired by General Electric, the task force is taking a serious look at the impact of workforce problems, skills gaps and STEM education programs across the country. I believe we all need to be operating from the same playbook in order to change the situation, and I am proud my association, the NAM, is committed to success in this area.

### **Conclusion**

The skills gap is real and poses a serious economic threat to American competitiveness. The bottom line is that if we as employers can't find quality applicants for jobs, it impacts our business and our profitability—something businesses are very concerned about. But please understand, this is not just about educating students to fill our positions. It's also about making sure our children have the opportunity and the tools to get a quality education, find a good, high-paying job and have the ability to achieve their dreams. Unless we and industry leaders engage ourselves personally in the solution, nothing is going to change. We need to partner with our schools and tell them what we need to create a system that meets the immediate needs of employers today; adequately train and prepare the workforce of the next five to ten years; establish a solid educational foundation for our children; and mentor young people on the benefits of manufacturing and STEM-related careers.

Modern manufacturing is no longer a dirty job, but as leaders in the industry, I believe we need to get our hands dirty to fix the skills gap problem. Industry-recognized credentials and mentoring—business leaders getting engaged with educators—have worked for me in Illinois. By definition, Quality Float Works, Inc. is a small business, but we are determined to make a large impact by changing our education and skills pipelines to create more opportunities for the next generation of the United States workforce.

Mr. TERRY. Dr. Lopez, you are now recognized for your 5 minutes.

#### STATEMENT OF LAZARO LOPEZ

Mr. LOPEZ. Thank you, Chairman Terry, Ranking Member Schakowsky, and members of the subcommittee.

The High School Survey of Student Engagement conducted by Indiana University has surveyed now more than 350,000 students across 40 States and found what parents of teenagers already know, that many of them are bored. So when Wheeling High School was redesigned as a comprehensive high school with a STEM focus, we wanted our school to be engaging by being relevant to our students in a way that prepared them for life beyond high school. So to engage students from the moment they enter our school, our conversations had to change. We didn't ask them, what do you need to graduate? Rather, we asked, what do you want to do with your life? And the answer to that question serves as the basis from which a school can embrace each student through the purposeful selection of electives within a career pathway, provide cocurricular activities that supports them, and partner with local businesses to facilitate external experiences that inform, all before they graduate high school.

By graduating students with a Diploma Plus, the choice is theirs to make. Whether the student transitions directly to a 2- or 4-year college, trade school, the military, as I did, or begins a meaningful career out of high school and returns to school at a later date. The student is in control because they have options.

There are three nonnegotiable principles that drove the work in the development of these pathways: One, a sequence of courses that led beyond high school on each one; external experiences that provide students a real-world understanding of career areas through internships, problem-based learning experiences; and, three, an opportunity to earn college credit or an industry certification. Students graduating with a Diploma Plus leave high school more competitive, already building her or his resume.

In examining the value of the career pathways as an effective education model, we want to understand how it impacts students. So I want to talk to you about Francisco. Francisco grew up in one of the tougher parts of town. He got into his first year of trouble throughout his time at school, and the deans all knew him by name. His teachers knew he was smart, but his path to graduation was far from assured; that is, until Francisco discovered the school's manufacturing program where something finally clicked.

Francisco worked extremely hard, staying after school at least 3 days a week to get one-on-one time on the machines. Francisco took the MSSC and NIMS certification exams, earning entry-level credentials, and he landed his first job at Holbrook Manufacturing in Wheeling. And since his graduation last December, after 4 ½ years in high school, Francisco is regarded by Holbrook as a model employee. And today Francisco is thrilled about being in manufacturing. He was proud to share with us that he's able to contribute financially to his family, noting that he was actually making more money than his mom. He's had multiple raises in the last 6 months and has already bought his first car. And he plans now to continue

his education at Harper College and earn an associate's degree specializing in CNC machining.

Now, while some students enter high school at risk, others may be successful academically, but need direction in discovering and fostering that passion. So think of our own college experience and how anxious you were to get to your major coursework. If we can connect the dots between what students are excited about in their future and the classes they take today, students are more engaged in class, more motivated to do the work, and more likely to challenge themselves with rigorous coursework, such as honors or Advanced Placement. We know students who self-identify with a specific career in mind prior to leaving high school are 80 percent more likely than their counterparts to earn a certification or degree 6 years post-high school.

So in this other example, Mallory entered the engineering/manufacturing program with a small spark of interest in how things are made. Her experiences in the Project Lead the Way Computer Integrated Manufacturing class; Robot Rumble, which we host locally; and the opportunity to design and manufacture her ideas into reality led her into an internship at Swiss Precision Machining. Even as she currently attends the University of California pursuing a degree in aeronautical engineering, she returned to Swiss in the summers to work, and she informed her teacher that it was one of the greatest opportunities she had; that in the summer, she did a lot of price quoting, figured out the most efficient way to machine parts, and she actually got to run the machine.

Today Mallory boasts an internship with the Air Force Research Laboratories in California. She says, "I feel like the biggest reason why I got that job was because of the machining experience I had. My boss was impressed with that opportunity at Swiss."

So the goal at Wheeling High School is to make the school relevant. That is why we house a state-of-the-art manufacturing facility, a hospital lab with a senior care facility, a nanotech research lab, and currently developing a business incubator lab. Our goal is to maximize the value of their high school experience.

And the work is scalable. Keep in mind, Wheeling High School is a nonselective Title 1 public school with a poverty rate now at 45 percent, and over half the incoming freshmen identified at risk. That means more than half are coming in at about a fifth-grade reading and math level. Yet in the last 6 years, we have grown by 80 percent and 24 AP courses, and ranked as one of America's best high schools, and designated as the national model for manufacturing/engineering education, with an SME prime designation.

School leaders must develop public-private partnerships that bring the outside world into the school and give students authentic, real-world experiences to practice 21st century skills in the context of their future. That was Francisco and Mallory's journey and the pathway out of boredom for students at the 24,000-plus high schools across America.

Thank you.

Mr. TERRY. Thank you.

[The prepared statement of Mr. Lopez follows:]

Committee on Energy and Commerce  
*Subcommittee on Commerce, Manufacturing, and Trade*  
2123 Rayburn House Office Building  
November 15, 2013, at 9:30 a.m.  
"Our Nation of Builders: Training the Builders of the Future"

**Written Testimony:** Dr. Lazaro Lopez, Associate Superintendent, Twp High School District 214, 2121 South Goebbert Road, Arlington Heights, IL 60004, [lazaro.lopez@d214.org](mailto:lazaro.lopez@d214.org), 847-718-7611

#### SUMMARY

Wheeling High School is a Title I comprehensive high school with a STEM focus organized around career pathways. The school offers 24 advanced placement courses, industry certifications, and numerous dual-credit opportunities. Recognized as one of "America's Best High Schools" by national rankings, it houses a state-of-the-art manufacturing facility, hospital lab with senior care facility, a first-of-its-kind in a public high school nanotechnology research lab, and currently we are developing a business incubator lab. Three key non-negotiable principles drove the work in the development of all pathways: 1) A sequence of courses that lead beyond high school; 2) External experiences that provide students a real world understanding of the career area such as an internship or problem based learning experience; and 3) An opportunity to earn college credit and/or an industry certification. The goal is for every student to graduate with a "Diploma Plus" and leave high school more competitive, with a career focus in mind. One of six comprehensive high schools in a district of 12,000 students, Wheeling became the district's first majority minority school in 2010. Today, 51 percent of its students are Hispanic and 45 percent identify as low income – up from 20 percent in 2002. Changing demographics meant we needed to change how we taught and how we engage students in order to make education relevant to their future.

**WRITTEN TESTIMONY**

The High School Survey of Student Engagement, conducted by Indiana University, has surveyed now more than 350,000 students across 40 states, and found what parents of teenagers already know, they're bored. So, when Wheeling High School was redesigned as a comprehensive high school with a STEM focus, we wanted our school to be engaging by being relevant to our students in a way that prepared them for life beyond high school.

To engage students from the moment they enter Wheeling High School, our conversations changed. We didn't ask, what do you need to graduate? Rather, we asked, what do you want to do with your life? The answer to that question serves as the basis from which a school can embrace each student through the purposeful selection of electives within a career pathway, provide co-curricular activities that support it, and partner with local business to facilitate external experiences that inform, all before the student graduates high school.

By graduating students college and career ready, the choice is theirs to make. Whether the student transitions directly to a two or four year college, trade school, the military or begins a meaningful career out of high school and returns to school at a later date, the student is in control because they have options.

Three key non-negotiable principles drove the work in the development of these pathways: 1) A sequence of courses that lead beyond high school; 2) External experiences that provide students a real world understanding of career areas through internships or problem-based learning experiences; and 3) An opportunity to earn college credit and/or

an industry certification. Students graduate with a "Diploma Plus" and leave high school more competitive, already building his/her resume.

What does a "Diploma Plus" mean, and more importantly how does it impact students? Back in 2009, with a small team of industry partners that has grown to more than 30, the school opened a manufacturing facility to complement its Project Lead the Way engineering courses. With industry donations, equipment deeply discounted, Perkins funding, and district facility improvement dollars, a state of the art, national model program was founded. Students can earn dual college credit, industry certifications, and have access to substantive, real-world internship opportunities.

In examining the value of career pathways as an effective education model, we must understand how it impacts students. Let me tell you about Francisco. Francisco grew up in one of the "tougher" parts of town, known for its gangs and police presence. He got into his fair share of trouble throughout his time at school; all of the deans knew him by name. His teachers knew he was a smart student, but his path to graduation was far from assured. That is, until, Francisco discovered the school's manufacturing program, where something finally clicked.

Francisco worked extremely hard, staying after school at least three days a week to get one-on-one time on the machines. At the end of the class, Francisco took the MSSC and NIMS certification exams, earning entry-level credentials. It was this work ethic he developed that inspired many industry partners to give him an interview. He landed his first job at Holbrook Manufacturing in Wheeling. Since his graduation last December, after 4 1/2 years in high school, Francisco is regarded by Holbrook as a "model" employee. Today, Francisco is still thrilled about manufacturing. He was able to purchase his first car,

a health care plan, and has had multiple raises in his 6-month career. Francisco was proud to be able to contribute financially to his family, noting that he was actually making more than his mother, who was also struggling to support them. As of today, Francisco plans on saving enough money to attend the local community college and earn an Associates degree specializing in CNC Machining.

This is one of many real examples that illustrate the impact of engaging students in a career path of interest. It literally has the potential of changing the trajectory of a family for generations. Now, while some students enter high school at-risk, others may be successful academically but need direction in discovering and fostering their passion.

Think of your own college experience and how anxious you were to get to your major coursework. If we can connect the dots between what students are excited about in their future and the classes they take today, students are more engaged in class, more motivated to do the work, and more likely to challenge themselves with rigorous coursework such as honors or advanced placement.

We know that students who self-identify with a specific career in mind when leaving high school are 80 percent more likely than their counterparts to earn a certification or degree six years post high school. Think of what that 80 percent translates into in federal and state financial aid for students who enter college without some experience in their high school years to inform their choices. I've met countless individuals who share with me they began college in engineering only to realize they didn't know what an engineer actually did. I always respond, that's because you didn't go to Wheeling High School. Think about the number of students who enter college thinking they want to do one thing, only to decide a year or two in, they no longer want to pursue their original career pathway. Establishing

career pathways in high school exposes students to a wide-range of opportunities, allowing them to eliminate career options early on and experiencing them first hand prior to spending a single dollar on a college education.

Mallory entered the engineering/manufacturing program with a small spark of interest in how things are made. Her experiences in the PLTW Computer Integrated Manufacturing class, robot rumble challenge, and the opportunity to design and manufacture her ideas into reality led her into an internship at Swiss Precision Machining. Even as she currently attends the University of California pursuing a degree in Aeronautical Engineering, she still returned to Swiss Precision in the summers to work. Mallory recently told her former teacher at Wheeling High School: "It's honestly one of the greatest opportunities I've had. This summer I did a lot of price quoting and figured out the most efficient way to machine parts. I also got to go on the floor and help run machines."

Today, Mallory boasts an internship with the Air Force Research Laboratories in California. She says, "I feel like the biggest reason why I got that job was because of the machining experience I had. My boss was very impressed with the opportunity that I had at Swiss and in the class."

So the goal at Wheeling High School is clear—to make high school relevant—that is why we house a state-of-the-art manufacturing facility, hospital lab with senior care facility, a nano-technology research lab, and currently developing a business incubator lab. And our goal for our students is simple—for each to maximize the value of their high school experience.

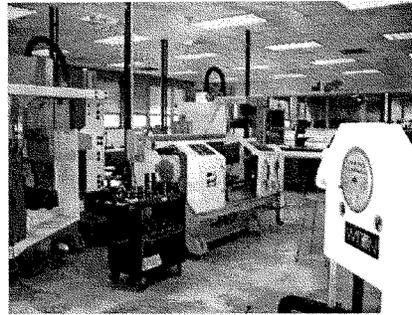
This work is **scalable**. Keep in mind, Wheeling High School is a non-selective Title I public school, with over half of the incoming freshman class identified at-risk and a school

poverty rate now at 45 percent. That means that more than 55 percent or more of the incoming students each year are reading and doing math at about a 5th grade level. Yet, in the last six years our enrollment in advanced placement has grown by 80 percent in 24 AP courses with more than 653 exams taken this past spring while maintaining an average pass rate over 80%. In spite of the challenges, national rankings in the last two years have recognized Wheeling as one of "America's Best High Schools." The school was one of the first to be recognized by the Society of Manufacturing Engineers Education Foundation as a national model for manufacturing and engineering education, with PRIME designation. School leaders must develop public-private partnerships that bring the outside world into the school, and give students authentic, real-world experiences to practice 21<sup>st</sup> century skills including teamwork, problem-solving, and utilizing technology.

By being responsive to the global economy and remaining flexible in the development and delivery of curriculum that is relevant to its students, public education can work for students such as Francisco and Mallory, and provide a direct access to fulfilling their American dream.



**Manufacturing/Engineering Pathway  
Advanced Manufacturing Lab (2009)**

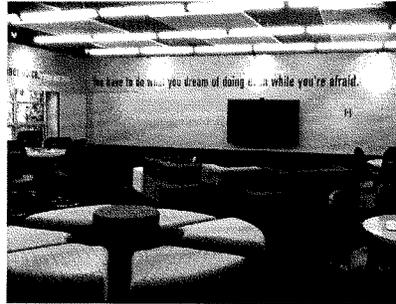


**Research & Development Pathway;  
NANO Technology Lab (2013)**



**Health Science Pathway  
Hospital Lab (2010)**

**Business Pathway  
*UNDER CONSTRUCTION*  
Business Incubator Lab (2014)**



Mr. TERRY. And our last witness before questions, Dr. Hill, you are recognized for 5 minutes.

**STATEMENT OF CATHERINE HILL**

Ms. HILL. Thank you. Chairman Terry, Ranking Member Schakowsky, and members of the committee, thank you for this opportunity to speak with you today about the Nation's future workforce. My name is Catherine Hill, and I am the Director of Research at the American Association of University Women, and those university women include many community college members as well.

Mr. Chair, I would like to request that our report "Women In Community Colleges: Access to Success" be entered into the record.

Mr. TERRY. So ordered; no objections heard.

[The report is available at <http://docs.house.gov/meetings/IF/IF17/20131115/101480/HHRG-113-IF17-Wstate-HillC-20131115-SD001.pdf>.]

Ms. HILL. On behalf of our 170 members and supporters, I am pleased to share our perspectives with you today about this very important part of our educational system, including over a third of the college students today who are at community colleges. And more than—more and more, we are seeing the students attend directly to community colleges, and that part of the student body is growing. Echoing a comment made earlier, we are going to need to make manufacturing cool to these new community college students, including women, who often see manufacturing as a guy thing.

Science, technology, engineering, and math is often discussed in terms of the college-educated workers and the Ph.D. workforce, but STEM is much more than that and includes many middle-skilled jobs, as you no doubt know. And to keep our competitive edge, we need to use all of our brainpower to fill these positions, including both men and women. Too often women aren't at the table, not at the lab, not on the manufacturing floor or the construction site, and we do need to change that.

AAUW believes that the community colleges could play a critical role in moving women into these roles and ending the shortage of women and workers in these STEM fields. By engaging our educators today, we are going to better be able to reach builders of tomorrow.

Women are nearly half of the U.S. workforce; they are only about a quarter of the STEM workforce. And women make up a very small fraction of many of our skill trades, such as electricians and mechanics. And many of these job, these middle-skill jobs, require either a little more than high school education, but less than a bachelor's degree, and there are about 29 million of these jobs in the country today. And we have many graduates coming into those positions, but we need more. Obviously, the career and technical system that trains people for this kind of a job is going to be really critical for our future.

So there are two major problems I want to mention today. One is that employers often discuss this mismatch in preparation and skills. And, second, we have very few women being prepared for some of these jobs.

Community colleges can provide solutions to both of these challenges. Workforce development has always been at the center of community colleges' mission, and they are well situated today with growing populations to be able to help serve this function in the future.

We see gender segregation at community colleges just as we do in the workforce, particularly in the STEM fields and some of these middle-skill credentials, and we know that community colleges can do better. Some of the research that we did found that community colleges are an especially good training ground for STEM and non-traditional fields. And we found that actually more women use community colleges at some point in their path to a STEM degree than men. So these are especially important to women, and I think that cost is a big part of that picture, because you can take a few classes inexpensively in a community college before making a commitment to the field. And this is important for people who are somewhat unsure of the field, but might, in fact, become very successful as they learn more about it.

There are a number of ways that we can reach out to women, recruiting them into some of these new programs. That includes things like childcare services, supportive learning environments, participation at a number of other kinds of events. We have more of these information on these recommendations in our report and in our written comments.

One last hurdle I wanted to mention before closing. Community colleges do not have the same level of data-rich information at we have for our 4-year programs. Our IPEDS data, our Federal data sets, don't cover all of the students in community colleges. And in particular, they have not been good in the past in talking about part-time students, who are a majority of our community college students.

If we want to know how community college students are faring, we need to know about all of the students at community colleges throughout their careers; so those are who part time, those who are full time, those who take longer than 2 years, and those who take even up to 4 or 6 years, and also those who transfer. We are getting better in this area, but it is something that we desperately need to see more work done so that we can better understand the program and better evaluate the programs so we know what is working.

In closing, I would like to say the community colleges are critical for educating the workforce in our manufacturing and building fields, and they are especially important to women who benefit from these opportunities that are not traditionally considered appropriate for them. If we want to build a strong future workforce, we need to ensure that both men and women are at the table and at the construction site.

Thank you for this opportunity, and I am happy to take your questions.

Mr. TERRY. Thank you, Dr. Hill. Appreciate your testimony.

[The prepared statement of Ms. Hill follows:]



**Written Statement of**

**Catherine Hill, Ph.D.  
Director of Research**

**American Association of University Women (AAUW)**

**United States House of Representatives  
Energy & Commerce Committee  
Subcommittee on Commerce, Manufacturing, and Trade**

***Our Nation of Builders: Training the Builders of the Future*  
November 15, 2013**

Chairman Terry, Ranking Member Schakowsky, and members of the Subcommittee, thank you for the opportunity to submit input about our nation's future workforce.

On behalf of the approximately 170,000 bipartisan members and supporters of the American Association of University Women (AAUW), I am pleased to share AAUW's perspectives on the challenges of expanding our nation's science, technology, engineering, and mathematics (STEM) workforce. AAUW's member-adopted Public Policy Program strongly supports "programs that break through barriers for women and girls in STEM."<sup>1</sup>

The title of this hearing, "Our Nation of Builders: Training the Builders of the Future," is very apt. Building and manufacturing in the future will take a great deal of training as our country seeks to maintain our competitive edge. But to keep that edge we need to have all possible brainpower at our disposal. We need smart men, and smart women. But all too often, women aren't at the table, and they're not in the laboratory, on the manufacturing floor, or construction site. We need to change that.

AAUW believes that community colleges can play a critical role in moving women into these roles and ending the shortage of women in science, technology, engineering, and math fields. By engaging today's educators, we can better reach the builders of tomorrow.

In May 2013, AAUW released *Women in Community Colleges: Access to Success*, offering recommendations for policy and practice to promote women's access and success at community colleges. This testimony is based on this report, and we submit it as part of this testimony.

Women are nearly half of the total US workforce (48 percent) but less than a quarter (24 percent) of the STEM workforce (Beede, Julian, Langdon, McKittrick, Khan, & Doms, August 2011). Women made up a small fraction of many construction trades such as electricians (1.8 percent), automotive service technicians and mechanics (1.2 percent), electronic home entertainment equipment installers and repairers (10.7 percent) (BLS, 2012a).

Many of these STEM jobs are “middle-skill” jobs that require more than a high school education but less than a bachelor's degree and offer average earnings of \$35,000 (Carnevale, Jayasundera, & Hanson, 2012). There are 29 million middle skill jobs in the US today so the career and technical (CTE) system is very important to our workforce and economic growth (Carnevale, Jayasundera, & Hanson, 2012). But at least two major problems affect our ability to meet demand for middle skill STEM workers. First, employers report a mismatch between student preparation and the skills they need (Pathways to Prosperity, 2011); and two, very few women are being prepared to pursue these jobs although women are the majority of postsecondary students. Community colleges can provide a solution to both of these problems by doing more to help students prepare for in-demand jobs and by promoting the participation of women in nontraditional fields like technology and engineering to meet workforce needs.

Gender segregation in the workforce begins at school. In community colleges, women earn the majority of certificates and associate's degrees in personal and culinary services, education, and health care. In contrast, men dominate STEM and STEM-related occupational fields and are nearly three-quarters or more of occupational or CTE sub baccalaureate<sup>1</sup> students in computer and information services, engineering, manufacturing, construction, repair and transportation (USDOE, 2008).

Despite women's underrepresentation in STEM and STEM-related CTE fields at community colleges, research suggests that community colleges can be a good training ground for women interested in STEM and nontraditional fields. While not all community college students are academically underprepared, women who want to improve their math and science skills can do so at a community college at low cost. Additionally, women interested in careers that require a bachelor's degree also use community colleges as a path to a four-year degree. Among STEM students, women were more likely than men to attend a community college at some point on the path to a bachelor's or master's degree in STEM (Tsapagos, 2004). Despite the range of opportunities in STEM at community colleges, research also suggests that women face several barriers in taking advantage of these opportunities.

**Women lack information about opportunities in nontraditional fields, including STEM.** Women are often unaware of opportunities in nontraditional fields, including STEM, early in their community college careers (Packard et al., 2010; Starobin & Laanan, 2008), but information plays a key role in recruiting women to technical fields (Mastracci, 2003). A survey by Women Employed Institute (2012), an advocate for women's economic advancement, found that women in low-wage jobs were more likely to consider IT as a possible career path after learning more about salaries, entry-level positions, and training opportunities in IT. But even after learning about opportunities in nontraditional fields including STEM, misconceptions about the nature of STEM work and career options remain a barrier. For example, women in the Women Employed survey thought that IT was too solitary a work environment and did not understand that IT jobs are available in many fields. Women were concerned about isolation and not having role models or support in fields with fewer women diminishing the likelihood of them committing to nontraditional or STEM fields.

---

<sup>1</sup> Sub baccalaureate refers to postsecondary degrees of less than four years usually awarded by a community college or technical school, including associate's degrees and certificates.

**Women face gender stereotypes and bias in entering nontraditional fields.**

Studies suggest that CTE programs can reinforce gender stereotypes. Some programs use assessment tests that have been found to be more accurate at predicting men's educational abilities and interests than those of women (Armstrong, 2000). For example, tests sometimes state that fields like welding and auto mechanics require that individuals are physically fit and able to lift heavy objects, so women are advised not to select these fields because it is presumed that they do not possess those characteristics (Lester, 2010). Stereotypes about women's ability in math also dissuade women from these fields. For instance, women who were anxious about taking higher level math courses reported their confidence grew as they persevered and improved (Starobin & Lannan, 2008). Encouragement and support from family, peers and faculty also play an important role (Reyes, 2011; Packard et al., 2010). Some women receive conflicting messages or a lack of emotional and financial support from their families who may not understand the demands of college work and/or who may be doubtful that the women have the academic skills to succeed in technical fields (Reyes, 2011; Starobin & Laanan, 2008).

The lack of familial support is often compounded by a lack of institutional support. For example, poor academic and financial aid counseling can delay transfer for community college students and increase overall cost. For example, if students take courses that are not accepted by the four-year schools, students may have to take additional coursework at the four-year institution which would increase the time to earn a bachelor's degree and increase their overall educational costs (Packard, Gagnon & Senas, 2011; Lester, 2010; Starobin, 2008).

The open door that is the hallmark of community colleges is only a first step. Full access goes beyond admission, providing women with access to all their educational options including nontraditional fields and STEM.

**Increasing the number of women in nontraditional fields, including STEM**

One of the primary reasons that women enroll in community colleges is to gain skills that will pay off in the job market. Women who are entering or re-entering the workforce are doing so out of economic necessity and want to earn wages that will adequately support themselves and their families. But women are still concentrated in relatively low-paying traditionally-female fields that leave them unprepared to compete for some of the fastest-growing and better-paying jobs in STEM and science and technical occupations.

Women often have limited experience in and awareness of nontraditional fields including STEM, are held back by stereotypical beliefs, and lack support to enter and persevere in these fields. Increasing outreach to women, improving advising services, and creating supportive learning environments can help to increase women's participation and success in STEM fields at community colleges.

AAUW makes the following recommendations for increasing the number of women who enroll and earn certificates and associate's degrees in nontraditional fields and transfer to four-year institutions to earn bachelor's degrees in STEM:

- **Recruit more women into nontraditional fields and STEM fields.** Many college departments assume that students will come to them, and don't reach out to potential

students who have not expressed interest. Increase outreach to and recruitment of women in nontraditional fields and STEM. Most women may not initially express an interest in a nontraditional or STEM field, but may be influenced by outreach and marketing that send the message that these fields are for men and women alike. Recruitment materials should also include information on job opportunities, earnings, and educational requirements for nontraditional and STEM fields.

- **Ensure that institutional practices such as academic and career advising do not reinforce stereotypes or promote discrimination of women.** Academic advisors are a key point of contact for students and academic advising promotes student success. Academic and career advisors (including faculty) can play a major role in increasing women's participation in fields where they are underrepresented. Academic advisors should be educated about occupational segregation, gender bias and the importance of promoting nontraditional careers to women and men.
- **Develop educational and career pathways to help students navigate STEM curriculum.** Program directors can map course and program requirements so students have a clear path to earning a degree and entering a career in STEM. Career pathway maps should also include examples of the kinds of jobs and wages students can expect depending on the degree they earn. Research suggests that this kind of information can help motivate students to persist until they achieve their goal.
- **Use creative instructional approaches like learning communities to support students.** Learning communities are where students take their math and science courses together in a cluster. The learning community facilitates relationships among students and between students and faculty and improves students' social and academic connections. Learning communities have been shown to improve student performance, especially in the first year of college and to promote student engagement and feelings of belonging (Scrivener & Cohan, 2011). Research suggests that learning communities are a promising intervention to foster women's success in STEM. Learning communities provide much needed peer support, create a sense of community, and help to promote feelings of belonging among students. Women who have support and feel like they belong in STEM fields are more likely to stay in these fields. Introductory courses that require little or no experience in technical fields are a good way to attract students and nurture their interest.
- **Expose women in nontraditional fields to role models and mentors.** Research suggests that women who persevere in nontraditional fields despite the barriers they face display resiliency. Successful women in nontraditional and STEM fields can serve as role models and mentors to female students, offer suggestions and strategies for success and reinforce the message that women can be successful in these fields.
- **Partner with local employers to connect students to available opportunities.** Students depend on their schools for information on what programs and credentials prepare them for various jobs and careers. Local employers can share information with community

colleges on the skills they need, job openings, and wage information, which community colleges can use to decide what programs and courses to offer and guide students.

- **Develop and implement transfer and articulation policies that link community colleges and four-year institutions in each state.** Articulation and transfer policies can be established by either states or by agreements between institutions. The goal of these policies is to improve coherence in curriculum and to facilitate the transfer of students across institutions, including the transfer of community college students to four-year institutions. For example, these policies often include rules about common course numbering across institutions, which makes it easier for students to transfer credit for courses completed from one institution to the next. State-level articulation policies that link two- and four-year institutions reduce the burden on individual students to navigate the transfer process. Research also suggests that community college students were more likely to earn a bachelor's degree in states with articulation policies that included common course numbering across two- and four-year institutions, the automatic transfer of associate's degrees, and common/statewide general education core requirements in contrast to community college students in states without similar policies.
- **Strengthen the gender equity provisions of the Perkins Act.** AAUW believes it is important that institutions and states be held accountable for both the participation and completion of women and girls in CTE programs and urges Congress to maintain the gender equity provisions of the Perkins Act (Perkins IV) when it is reauthorized to continue to promote the success of students in nontraditional fields. The gender equity provisions in the law require recipients of Perkins funds to recruit students into nontraditional programs and hold them accountable for participation and completion rates of students. This is the best way to ensure that institutions that receive Perkins funds have incentives to provide the full range of programming necessary to fight women's persistent under-representation in CTE programs, especially those fields that are nontraditional for their gender. These measures help to ensure that women have access to, participate in, and earn degrees in nontraditional fields in science and technology that help them be competitive in the workforce.
- **Collect better data.** Our current federal data source on higher education outcomes does not adequately serve community colleges. The Integrated Postsecondary Education Data System (IPEDS) has two specific shortcomings that prevent an accurate assessment of community college data: First, IPEDS reports graduation rates or completion rates only for full-time, first-time degree or certificate seeking students who begin in the fall. This excludes many community college students who may be well served by their institution but still had to stop-out or fit a nontraditional schedule during their time in higher education. Second, students who complete their associates degrees or certificates before transferring to a four-year institution are counted as graduates, but are not included as a transfer student in the IPEDS data. This obscures the true picture. How are policy-makers supposed to design good policies if they don't know what's going on?

#### **Conclusion**

Community colleges are a vital component of the US higher education system and are central to

building an educated workforce. Community colleges are also particularly important in providing access to higher education to millions of Americans, including many women. Without community colleges many fewer women, African Americans, Latinos, student-parents and low-income students would have the opportunity to pursue higher education. Maintaining this commitment to providing access while supporting student success requires that community colleges address the challenges facing their students. In particular, community colleges need to be more attuned to women's lives and educational needs.

Women will benefit most from a community college sector that is committed to providing access as well as supporting their success. However, so too will the country. When women have the resources, support, and tools to reach their fullest potential they are strong contributors not only to the economic well-being of their families but also to the sustained economic vibrancy of the country.

Thank you for this opportunity. We are pleased to be working with you on this critical issue.

---

<sup>1</sup> AAUW. (2013). *2013-2015 AAUW Public Policy Program*. Retrieved August 5, 2013, from [www.aauw.org/resource/principles-and-priorities/](http://www.aauw.org/resource/principles-and-priorities/)

Mr. TERRY. It is now our time to ask you questions. Each Member has 5 minutes to ask questions and have a colloquy with whoever they choose to ask questions to.

So I am going to start off with more of a general question, but set up by Ms. Knox within your testimony was some alarming statistics about the lack of computer science teachings within our schools. But there also seems to be, at least looking around where I live, a lack of teaching trade skills anymore. And it comes back to what Ms. McNelly said in that we have become a culture that says basically—and I will admit I am guilty of this with my three sons. Since they have been able to talk, I have asked them questions like, “What college are you going to?” We have this culture that if you are a high school, and you are not placing X amount of people in great colleges, then you are not a good high school. Or community colleges that are now advertising come to us, and we can provide you the affordable first 2 years, get all of your basic core college classes out of the way cheaper, and have pushed some of the trade education that was once within their jurisdiction out to make room for the more affordable 2 years of college.

So how do we break through this attitude that parents have, that has permeated into both our K through 12 and our community college? So, Ms. McNelly, I wanted you to say something, and then I am going to come back to Dr. Hill and then Dr. Lopez.

Ms. MCNELLY. Thank you, Chairman Terry.

I think there was a common theme here in measuring what matters. And actually to your point that not just parents do we have an expectation, but equally within counselors, how they counsel students as to what an important performance outcome is. And I do think within the jurisdiction of Congress there should be a way in which to look at what performance outcomes in an education environment actually truly mean, to Dr. Hill’s point that somebody who’s a part-time student and actually is working full time or gets an industry-based credential and gets a job is actually considered a negative outcome within the education system. Therefore, it is shadowed either off on the side without credit, customized job training, or it is considered a negative impact.

And I think there probably is some action that could look at connecting the data points and what defines success, because certainly from a manufacturing perspective, you measure what matters. And if getting a job matters, then we need to be able to count that, too.

Mr. TERRY. Well, I appreciate that.

Dr. Hill, particularly focusing on the role of community colleges and maybe the trend away from tech, technical skills.

Ms. HILL. Absolutely. I will point—you are absolutely right that people are now looking at community colleges as the inexpensive first 2 years of their 4-year programs. We also want to see our associate degree programs and our certificate programs to be well utilized. And I think you do have a level of—little bit of a PR problem maybe where we need to start talking about those credentials with greater—I will say the word “respect,” and seeing those as really adding and contributing to our societies.

Mr. TERRY. Can a community college be both a tech school and the first 2 years? In a way, don’t those themes conflict with each other, at least through public perception?

Ms. HILL. Certainly. There is a wide variety of community colleges in our systems. And as I am sure most of you have interacted with various community colleges throughout your careers, you can see that some—they really try to talk about the current work site and workforce needs in their communities. And this new system—we do ask our community colleges to be all things to all people, and sometimes we may need to make some hard choices.

Mr. TERRY. Well, I respect that.

I am going to unfortunately not have time for you, Dr. Lopez, but I think that this is an important area, and you will get asked a lot of questions on it. But I will get one editorial comment in defense of community colleges, and I think the movement to being the first 2 years is an unintended consequence of how high tuition rates have really become.

At this time I recognize the ranking member, Jan Schakowsky.

Ms. SCHAKOWSKY. First I want to say to Ms. Westlund-Deenihan, I should have been welcoming you as an Illinois manufacturer, but—and close to my district, not in it. But I think one of the points that you are making is that, instead of importing workers, we need more companies that export products made by American workers. I am hoping I can rely on you in my district to talk to some of my smaller businesses about exporting and how we can—that would be great.

Dr. Lopez, I wanted to talk to you about Wheeling. I am thinking—as you talk, I am thinking about other high schools that are in my district and going into them, and I am not seeing laboratories, I am not seeing machines. You are a Title 1 school. This is not a privileged school. How did you manage to bring in the nanotechnology lab? I know that Secretary Duncan came to visit you last month. How can I help the other schools in my district to develop for their students who fit your demography pretty well to have the same kinds of things?

Mr. LOPEZ. You know, the first thing I would say is the reason we have the facilities, certainly they are—they are great to have and they are cool, but the real reason is because we need to bring the outside world in, especially in the communities who “I don’t have an uncle who is an engineer, I don’t have a family friend that can take me to the hospital.” So we need bring that into the schools. So that really was a driving factor, and also exposing kids to what is possible. When you live in a secluded environment, and all you know is your neighborhood, you don’t know what is possible.

Ms. SCHAKOWSKY. Well, where are the resources to bring it in?

Mr. LOPEZ. So in order to pull that—what I will tell you is that I am a second-career educator and spent a lot of time in business, and what I did is—you have to partner. You have to go out and tell your story to every business and every government agency that will listen to you. So we partnered with the Department of Commerce and Economic Opportunity, and they did invest heavily in our facilities and I know they are willing to—

Ms. SCHAKOWSKY. That is an Illinois agency.

Mr. LOPEZ. That is an Illinois agency, Illinois Department of Commerce and Economic Opportunity. As well as the Illinois Science and Tech Coalition, who is a private foundation supporting

science and technology development in Illinois, who have a vast array of industry partners that can come to bear and help support through experiences and internships.

But I will also say that you have to believe that absolutely anything is possible, and you have to go out there as I have to emphasize the role of the school leader. They have to go out there, and they have to sell their school, and they have to make it happen, and they have to bring those businesses and sell them that their students can provide a win-win relationship with them so that they have an opportunity to partner and have future employees for their companies.

So there is—

Ms. SCHAKOWSKY. So you said that it is scalable, meaning—

Mr. LOPEZ. Yes.

Ms. SCHAKOWSKY [continuing]. That it is not just the fact that you are such a dynamic leader, but that we can do this in other places.

So how do we teach the leadership of these schools to be able to do this?

Mr. LOPEZ. You know, what I will say is that the school leaders today really need to be sensitive and understand the economic realities in their community and then in their broader region so that they know what are the strengths of that community, and that is what you begin to build on.

And so we do need our school leaders to recognize that they don't work in a vacuum anymore. It is not about giving the kid just a high school diploma; it is about preparing them for life. So they have to be engaged with the same network of Chambers and business communities so they know what they can do so that their kids have a future once they leave, and be creative, and think outside the box, and believe and make things happen. And I think it is certainly possible.

Ms. SCHAKOWSKY. OK. Ms. Knox, looking at—your written testimony has so much, it is just a wealth of information. One of the charts I am looking at, 15 States that count computer science toward high school graduation requirements, that is really just a few, and I notice my State is not among them. So are you saying that the State boards of education, et cetera, require that? Tell me more about that.

Ms. KNOX. In the States that do count it, it is basically the State is rewarding the student with either a math or science credit which is counted toward high school graduation. In the cases where it is not counted in that way, if you were to take computer science as a student, what happens is you receive an elective credit.

Ms. SCHAKOWSKY. I see.

Ms. KNOX. And in many States, that would be like taking cooking class.

There are seven of you here right now, and five of the States don't count it that you represent. And we are actually actively in those States right now with State boards of education, State superintendents. We would love your partnership and help in raising the issue and asking for this simple—not requirement, this way of rewarding students for taking computer science.

I want to just add that we have had focus groups with students and asked them why they are not taking computer science, and they have said, well, that is where the dumb kids go. And when you ask them, why do you think it is where the dumb kids go, they said, well, I want to go to college, and I need to take as many math classes as possible. This isn't a math class; this is an elective class.

Ms. SCHAKOWSKY. Yes. Let me just say, I don't know if you mentioned in your testimony, that, Ms. Westlund-Deenihan, you are also chair of the Illinois State Board of Education's Gender Equity Advisory Committee, and I would like to talk more—I am out of time, but I would like to talk to you more about that as well. We do need more girls to take these classes and more women involved in STEM and in manufacturing. Thank you.

Mr. TERRY. Mr. Guthrie, you are recognized for 5 minutes.

Mr. GUTHRIE. Thank you, Mr. Chairman.

And thank you guys for being here. I appreciate it very much.

This is very near and dear to me. I worked in manufacturing before I came here. My family has an aluminum foundry, automotive supply business, and I can tell you what you are talking about—trying to find skilled workers, machinists, tool and die makers—is just extremely difficult to do. And they can make really good incomes. And almost all of our managers—like, middle-level and some higher-level managers—came to us from a tech school background and just worked their way through the system of the company. So not only is it good entrance level for wages, but it also is a great forward-level rise for wages.

So it is something that has been near to me, and I have got a bill out called the REBUILD Act, which is about American manufacturing, reducing employer burdens, unleashing innovation, and labor development is the LD part of it. And it has got a lot of different principles or parts to it, but one is the America Works Act, and that we are trying to push forward.

And, you know, a couple—one thing I was going to ask you, but we are about out of time, so I just want to get straight to the other, is what can the government do, how we are getting in the way.

But one thing of it is—and, Dr. Lopez, I do want to say that I was in the State legislature on the education committee, and tried to find schools that you wouldn't predict being successful that were, because I don't think you point at failure, you try to find success and replicate and scale it, and it was always a school leader. Not saying they didn't have great staff, they didn't have great teachers, they didn't have a great system backing them, but you could have all of that and a poor school leader, and the school was failing. So that is what we have to replicate actually, strong leadership at the school level.

But the one thing that I have always kind of wondered, I cannot walk into a manufacturing plant—I love to go in them, so I go in every one in my district—without the manager saying or the human resources person, “We cannot find skilled labor. We can't find it. We can't find it. We can't find it.” And this is not \$10-an-hour jobs. These are the up-in-the-\$20-an-hour jobs.

So, for some reason, in this level of employee, the market is failing, because the market—the jobs or the supply or the demand is there, they are paying pretty good prices for it, particularly what

some of these people get anywhere else, but for some reason the market is failing to develop that skill of worker.

Does anybody have an idea why the market is failing to do that, what is competing with that market, and where these kids are going? Yes. Any of you. I just open up to the—

Ms. WESTLUND-DEENIHAN. Well, I would blame that on business, because business has not been talking to the community colleges in the past and not really telling them what our needs are as far as where the real jobs are, what curriculum is important and relevant to the workforce.

And I think that addressed something that Chairman Terry said before. You know, if—why are these being turned away, these jobs? I think a lot of it is responsibility of business. We have not been working with community colleges. It is important for us to talk about it. In the past maybe we have tried to throw money at it, a scholarship, or we have given some piece of equipment that is—doesn't have all its parts and is not relevant to real workplace jobs. And it is more important for business to provide—to mentor, to talk to community colleges and tell them, you know, regionally what are the skill sets that are needed for the jobs that you have available, provide internships.

And, for example, we even have a—for high schoolers we provide a program that is a work-study program to have kids that are good with hands-on to come in to work—go to high school in the morning and in the afternoon come and work—and get paid to be able to have skill sets so that they will be able to graduate with a vocational training and, you know, go on.

Mr. GUTHRIE. Yes. I think Dr. Lopez looks like he wants to answer. But the bill that I am working with and am part of, that it is a business majority, the Workforce Investment Board has to be a business majority, business quorum so that when Federal money flows, it is flowing to people—to say these are the people we want. These are who we are going to put to work and to hire.

Dr. Lopez, I think you were anxious to jump in.

Mr. LOPEZ. And I will just take a couple of seconds. Can I just say this is a space where Perkins and CTE funding really has had a significant impact at schools being able to buy that equipment and be innovative, and that that is certainly an area that is needed for support? And schools across the country were closing these facilities down. They were closing their manufacturing facilities. And I think there has been a lot of work by SME and by NAM to encourage high schools to go back and open those spaces and buy modern equipment so that it is relevant, and engaging and available to their local community.

Mr. GUTHRIE. It is strange, because showing up in a manufacturing plant with maybe just your high school diploma and saying, "I am here to go to work," it is hard for a company to afford to be able to—your productivity level to afford to pay. Those are the jobs that we have lost. But if you show up with a skill—

Mr. LOPEZ. Yes.

Mr. GUTHRIE [continuing]. And you can program a machine, you can make a middle-class income in manufacturing today on the factory floor if you have those skills. So that is great that we are here.

Thanks, Mr. Chairman.

Mr. TERRY. I would give you a little leeway, but we have 5 minutes and 12 seconds to go vote, of which Mr. McNerney is going to use 5 minutes of that.

Mr. MCNERNEY. Or less.

Mr. TERRY. You are recognized for 5 minutes, and then we are going to adjourn.

Mr. MCNERNEY. Thank you, Mr. Chairman.

I really appreciated Ms. McNelly's comments about making manufacturing a cool pathway for a career, and I think what Dr. Lopez is talking about helps that. I mean, if you see that as cool, or if you see it as relevant to your life, you are going to put a little more into it. You are going to make it cool. So we need to hear more about how to do that.

Having your institutes where you can learn about different things that are relevant is very important. It is something that we need to focus on, I think, empowering our schools to do that. Schools in my district that do that are having a good deal of success.

But something that Ms. Knox said is that we need to support teachers. I think we need to make teaching cool, because if we don't get the best teachers out there, if we don't have good teachers out there, and I don't say we don't—but we need the best teachers out there. We need to make teaching cool. So that is something we need to focus on a little bit, too, in my opinion.

Any way we can attain that goal, Ms. Knox? How do we get that support out to teachers? How do we make them feel like that is where they want to be?

Ms. KNOX. We have done a little research here, and one of the key areas is that the incoming student to the teacher preparation program needs to feel that they can actually make a difference. And so there is a campaign that is being launched. It is a public-private partnership among many different players called Teach.Org to attract people into the teaching profession, but also I think we can make sure that we are supporting Title 2 of the Higher Education Act, because there is a piece in there to make sure that teacher preparation is strengthened.

So you want to go into a field, want to be attracted to a field where you are not isolated, where there is a career ladder, where you feel like you can make a difference.

Mr. MCNERNEY. And prestige in the community as well.

Ms. KNOX. Yes. I mean, there are some great books on this right now, "The World's Smartest Kids and How They Got That Way." And there is a comparison of three different countries with the United States, and the way that teachers are revered in other countries and the way they are attracted into the profession is radically different than in America.

Mr. MCNERNEY. I would venture to guess that just about everybody on this committee had a teacher that made a difference in their lives.

Ms. KNOX. Sure.

Mr. MCNERNEY. Ms. Hill—

Ms. HILL. Yes.

Mr. MCNERNEY [continuing]. One of the things that I understand is that there are more women graduating from university now than there are men.

Ms. HILL. Absolutely, yes, at the 4-year level and at the 2-year colleges.

Mr. MCNERNEY. But there is still a huge income gap.

Ms. HILL. Oh, yes. What we see happening is that women and men are going into different fields, and women are not going into some of these middle-skills fields that they feel are somehow not important or just simply not for them. And one of the things that we do is look at some of the stereotypes and bias that all of us carry around with us, and yet we can ask ourselves to look again at those biases and help women look at fields that are not traditional for them. And there are a number of different techniques and programs that are helping to do that today among educators, as well, and among young women, because, of course, we have these internalized.

But one of the challenges that I wanted to mention in any of these programs is that I have seen community colleges say that they don't have enough people who want to take these classes in middle-skill jobs, the, you know, electrical jobs and the welding jobs, that they don't have—and so they don't offer them, which means that then, of course, people don't look to them to provide those jobs. So someone is going to have to get it started. And I think for women, getting them excited and interested in these programs can be as simple as having them in a brochure.

And this idea of active recruiting is something I want to stress. I think a lot of programs at colleges, professors don't think they need to recruit students. I mean, that isn't something that they have done in the past. But when we have areas where we really want more students going into these areas, we do need to recruit them actively.

Mr. MCNERNEY. Thank you, Mr. Chairman. I yield back.

Mr. TERRY. Thank you. And that does conclude our hearing. And the committee has the right under our rules to submit questions to you. I don't know if any will be, but if there are, we would appreciate a 2-week turnaround in answering those.

I do have a feeling that our staffs will be reaching out to you. Jan and I are very passionate about finding a solution, but we are going to need your continued advice, and counsel and direction.

I want to thank you all for coming here and providing your testimony and your answers, and you have been of great assistance to us. We are adjourned.

[Whereupon, at 10:45 a.m., the subcommittee was adjourned.]

[Material submitted for inclusion in the record follows:]

FRED UPTON, MICHIGAN  
CHAIRMAN

HENRY A. WAXMAN, CALIFORNIA  
RANKING MEMBER

ONE HUNDRED THIRTEENTH CONGRESS  
**Congress of the United States**  
**House of Representatives**  
COMMITTEE ON ENERGY AND COMMERCE  
2125 RAYBURN HOUSE OFFICE BUILDING  
WASHINGTON, DC 20515-6115

Majority (202) 225-2927  
Minority (202) 225-3641

**Statement of Rep. Henry A. Waxman**  
**Ranking Member, Committee on Energy and Commerce**  
**Hearing on "Our Nation of Builders: Training the Builders of the Future"**  
**Subcommittee on Commerce, Manufacturing, and Trade**  
**November 15, 2013**

Thank you, Mr. Chairman, for holding today's hearing to explore what needs to be done to ensure that American workers have the skills they need to succeed in the future. And thank you, Ranking Member Schakowsky, for your keen interest in this topic throughout the year.

Over the course of the last year, this Subcommittee has heard time and again from industries that they are having to leave jobs unfilled because they cannot find properly skilled workers. With our unemployment rate still way too high, this is simply not acceptable.

As this Subcommittee has learned, these unfilled jobs are often in fields requiring education or training in the STEM fields – science, technology, engineering, and mathematics. In addition, we understand that there is a growing need for STEM training at the high school or community college level, not just a demand for individuals with graduate-level STEM degrees.

Manufacturing jobs have changed. Where once it might have been common for a high school graduate to get a stable, well-paying factory job on the assembly line, today's jobs in manufacturing plants often require technical skills or an associate's degree. And they almost certainly require the ability to understand complex machines and processes and quickly solve any problems that may arise.

According to manufacturers, an enhanced emphasis on STEM and improvements in STEM curricula would greatly help domestic manufacturing industries and support growth, jobs, and national security.

Increasing the numbers of STEM-trained workers not only helps our manufacturers and other STEM-dependent industries, it helps workers. Not only does STEM help them develop analytical and problem-solving abilities, it may help them acquire more specialized expertise in an area of interest. Furthermore, it will help them provide for their families, as STEM occupations have higher wages, on average, than those outside STEM fields.

The Administration also has pushed STEM education from day one. Its Educate to Innovate initiative, launched in 2009, has brought together over 100 CEOs and raised over \$700

million to support several public-private programs designed to: (1) mobilize the business community to improve the quality of STEM education; (2) recruit and prepare 100,000 new, effective teachers in STEM fields over ten years; and (3) promote broader participation in STEM fields by girls and women and traditionally underrepresented ethnic minorities.

At this hearing, I hope to hear what high schools, community colleges, and manufacturers are doing to meet this growing demand for STEM-trained workers. In particular, we need to understand not only what they are teaching and how they are partnering with each other but also whether our schools have the regional data necessary to point eager students on a path toward a successful career. We also need to understand what companies are doing to retrain or otherwise provide opportunities for their older workers and learn how STEM can help narrow the wage gap for women and men.

I am hopeful that this hearing will help us understand how to make STEM education as effective as possible. STEM is a critical piece of the broader economy, and thus, STEM training is a necessary part of our continued economic progress.

Thank you.

FRED UPTON, MICHIGAN  
CHAIRMAN

HENRY A. WAXMAN, CALIFORNIA  
RANKING MEMBER

ONE HUNDRED THIRTEENTH CONGRESS  
**Congress of the United States**  
**House of Representatives**  
COMMITTEE ON ENERGY AND COMMERCE  
2125 RAYBURN HOUSE OFFICE BUILDING  
WASHINGTON, DC 20515-6115  
Majority (202) 225-2927  
Minority (202) 225-3641

May 28, 2014

Ms. Jennifer McNelly  
President  
The Manufacturing Institute  
National Association of Manufacturers  
733 10th Street, N.W., Suite 700  
Washington, D.C. 20001

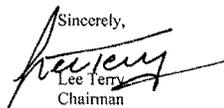
Dear Ms. McNelly,

Thank you for appearing before the Subcommittee on Commerce, Manufacturing, and Trade on Friday, November 15, 2013 to testify at the hearing entitled "Our Nation of Builders: Training the Builders of the Future."

Pursuant to the Rules of the Committee on Energy and Commerce, the hearing record remains open for ten business days to permit Members to submit additional questions for the record, which are attached. The format of your responses to these questions should be as follows: (1) the name of the Member whose question you are addressing, (2) the complete text of the question you are addressing in bold, and (3) your answer to that question in plain text.

To facilitate the printing of the hearing record, please respond to these questions by the close of business on Wednesday, June 11, 2014. Your responses should be e-mailed to the Legislative Clerk in Word format at [Kirby.Howard@mail.house.gov](mailto:Kirby.Howard@mail.house.gov) and mailed to Kirby Howard, Legislative Clerk, Committee on Energy and Commerce, 2125 Rayburn House Office Building, Washington, D.C. 20515.

Thank you again for your time and effort preparing and delivering testimony before the Subcommittee.

Sincerely,  
  
Lee Terry  
Chairman  
Subcommittee on Commerce,  
Manufacturing, and Trade

cc: Jan Schakowsky, Ranking Member, Subcommittee on Commerce, Manufacturing, and Trade  
Attachment

Response of:  
 Ms. Jennifer McNelly  
 President  
 The Manufacturing Institute  
 National Association of Manufacturers

Additional Questions for the Record

**The Honorable Lee Terry**

1. Why is the traditional “learn on the job” approach no longer a viable option for many manufacturers?

*The skills demanded in today's manufacturing sector are much greater than in generations past because of the increased use of technology and automation. New employees cannot learn how to operator, maintain, and program the machines that do much of the work on the factory floor simply by watching or “learning on the job.” Those skills require intensive programs of study at technical schools or community colleges.*

**The Honorable Jan Schakowsky**

1. One major challenge in promoting STEM is helping students understand why subjects involving math and science are relevant to their life and their future. It is much harder to convince high school students to study hard in STEM classes if those classes do not relate to the real world around them. It is also hard to convince college students or mid-career workers to seek out technical education in a STEM field if you can't tell them where the job opportunities of the future are going to be.

Please list steps manufacturers can take, on a national and a regional level, to pool their knowledge and help schools, students, and workers better understand where the jobs will be in the future. Please also address what can they do to ensure administrators offer and students take the right courses for those jobs.

There are several activities that manufacturers can do to better help student and workers understand where the jobs will be:

1. *Improve their “signaling” to the market of the number and types of jobs available at their company. This would better communicate the specific skill sets required for employment at the company and, at the regional or national level, demonstrate an aggregate demand for qualified applicants so students and parents believe that there are real jobs making good money available in manufacturing.*
2. *Offer internships, apprenticeships, or co-op work programs for students in manufacturing education programs. This would offer students the chance to work in manufacturing as they are learning the required skills in school. It would also strengthen the relationship between companies and schools and potentially offer a feedback mechanism to those schools on the quality of the programs offered and any new programs or skills that may be required.*
3. *Incorporate the NAM-Endorsed Skills Certifications into their hiring and promotion practices. Manufacturing skills certifications are increasingly being offered by high schools, community colleges, and technical schools and if companies begin to prefer or require them for position at their company, this will drive further adoption of those credentials. Certifications have the benefits of validating the skills of potential employees and ensuring that administrators offer courses that teach the right skills. Certifications*

Response of :  
 Ms. Jennifer McNelly  
 President  
 The Manufacturing Institute  
 National Association of Manufacturers

*have the added benefits of conveying prestige upon the holder of that certification and the careers that require them. This is important in helping to attract new people to careers in manufacturing.*

2. Women have historically been underrepresented in STEM fields, a disparity that continues today. This hurts women, because STEM jobs, on average, pay more. It also hurts families who rely at least in part on a woman's economic contribution to a household. And it hurts the country, because we senselessly end up with fewer STEM-knowledgeable workers than we otherwise would have. How can manufacturers increase the number of women in STEM fields? What are the most important steps they can take?

*Women indeed represent an untapped resource for manufacturers. Only 24% of the manufacturing workforce is female. The way to attract more women into STEM fields in general and manufacturing specifically is to show that there are good careers available in those fields and to provide examples of women that are succeeding in those fields that can act as role models for girls and young women. The Manufacturing Institute is trying to accomplish this through our STEP Ahead which has recognized 280 women leaders in manufacturing and empowered them to be ambassadors and role model for young women in their community.*

*In addition to creating a network of professional role models, The Manufacturing Institute launched a partnership with the National Girls Collaborative Project (NGCP) to mobilize women in manufacturing to mentor the next generation of girls. The NGCP is to bring together organizations throughout the United States that are committed to informing and encouraging girls to pursue careers in science, technology, engineering, and mathematics (STEM).*

#### **The Honorable Bobby Rush**

1. Please explain how urban schools – particularly those in communities of color – are working effectively with students as well as colleges and prospective employers to ensure that they understand the opportunities and rewards of obtaining STEM-related certificates leading up to college and/or high-skilled employment.

*In developing a manufacturing workforce, The Manufacturing Institute is working with technical high schools to support efforts to align manufacturing education to the NAM-Endorsed Skills Certification System. Students graduating from these programs have the opportunity to enter the workforce with credentials that lead to a manufacturing career and in most cases also articulate into community college programs of study.*

#### **The Honorable Donna M. Christensen**

1. During the hearing, we heard that one reason for the lack of students preparing for manufacturing-related jobs was that manufacturing is simply not viewed as "cool." How can this be addressed, and what role can employers (like Microsoft) play in this effort? At the

Response of :  
Ms. Jennifer McNelly  
President  
The Manufacturing Institute  
National Association of Manufacturers

same time, for those students inclined to go into manufacturing jobs, how do we best communicate what types of skills and training are necessary – whether following a path of industry certifications or pursuing a 4-year degree?

*This biggest way that the perception of manufacturing can change is for companies to show what today's manufacturing actually look like. Manufacturers use some of the most advanced equipment and technology in the world but few people know about it. One effort to change that perception is National Manufacturing Day. The past two years, on the first Friday in October, manufacturers have invited students, teachers, guidance counselors, and community leaders to tour their plants and see what today's manufacturing looks like. Over 1,000 companies and 40,000 people have participated in these events.*

*Once a student decides he/she is interested in manufacturing, then the technical programs need to be available in communities to provide students with the skills required to succeed in manufacturing. This includes high school technical education and community college manufacturing programs with dual-enrollment across those programs and certifications to validate skills. Attracting students to these programs requires smart communication about the companies participating in them, the chance to earn college credit and work towards a degree, and near certainty of a job waiting for them upon completion.*

FRED UPTON, MICHIGAN  
CHAIRMAN

HENRY A. WAXMAN, CALIFORNIA  
RANKING MEMBER

ONE HUNDRED THIRTEENTH CONGRESS  
**Congress of the United States**  
**House of Representatives**  
COMMITTEE ON ENERGY AND COMMERCE  
2125 RAYBURN HOUSE OFFICE BUILDING  
WASHINGTON, DC 20515-6115  
Majority (202) 225-2327  
Minority (202) 225-3641

May 28, 2014

Ms. Allyson Knox  
Director  
Education Policy and Programs  
Microsoft  
901 K Street, N.W., 11th Floor  
Washington, D.C. 20001

Dear Ms. Knox,

Thank you for appearing before the Subcommittee on Commerce, Manufacturing, and Trade on Friday, November 15, 2013 to testify at the hearing entitled "Our Nation of Builders: Training the Builders of the Future."

Pursuant to the Rules of the Committee on Energy and Commerce, the hearing record remains open for ten business days to permit Members to submit additional questions for the record, which are attached. The format of your responses to these questions should be as follows: (1) the name of the Member whose question you are addressing, (2) the complete text of the question you are addressing in bold, and (3) your answer to that question in plain text.

To facilitate the printing of the hearing record, please respond to these questions by the close of business on Wednesday, June 11, 2014. Your responses should be e-mailed to the Legislative Clerk in Word format at [Kirby.Howard@mail.house.gov](mailto:Kirby.Howard@mail.house.gov) and mailed to Kirby Howard, Legislative Clerk, Committee on Energy and Commerce, 2125 Rayburn House Office Building, Washington, D.C. 20515.

Thank you again for your time and effort preparing and delivering testimony before the Subcommittee.

Sincerely,



Lee Terry  
Chairman  
Subcommittee on Commerce,  
Manufacturing, and Trade

cc: Jan Schakowsky, Ranking Member, Subcommittee on Commerce, Manufacturing, and Trade  
Attachment

TO: Subcommittee on Commerce, Manufacturing and Trade, Energy and Commerce Committee, U.S. House of Representatives  
 FROM: Allyson Knox, Director, Education Policy and Programs, Microsoft  
 DATE: Wednesday, June 11, 2014  
 SUBJECT: Answers to Additional Questions for the Record for November 15, 2013 Subcommittee Hearing entitled "Our Nation of Builders: Training the Builders of the Future"

---

**The Honorable Lee Terry**

1. You cite the declining availability of computer science classes – including a 33 percent reduction in AP computer science classes --- since 2005. Do we have any indication why these classes are disappearing?

**ANSWER:** Although the number of overall STEM AP Exams taken rises each year, the percentage of students taking AP Computer Science remains low. In 2013–14, only about 2,500, or less than 6 percent, of all high schools in the U.S. were certified to teach AP Computer Science. It is estimated that by the end of the decade, over half of STEM jobs will be in computing. This skills gap will have major consequences for American economic growth and global competitiveness. To address this, computer science needs to be recognized as an essential component of American education.

The low numbers of students taking AP Computer Science is even more staggering when one disaggregates the data. In 2013, no female students took AP Computer Science in Mississippi, Montana and Wyoming. That year, no African American students took the exam in Alaska, Idaho, Kansas, Maine, Mississippi, Montana, Nebraska, New Mexico, North Dakota, Utah and Wyoming. In addition, no Hispanic students took the exam in Alaska, Idaho, Kansas, Mississippi, Montana, Nebraska, North Dakota and Wyoming. The economic and job consequences will be very real for states like North Dakota where tech employment grew faster than any other state in 2012. The lack of computer science education is preventing minority students from accessing higher-skilled, higher-paying jobs, and preventing US employers from filling critically important jobs in company's large and small across the US.

The declining availability of computer science courses and the low number of participation in those classes can be attributed to three main factors:

1. K-12 students are often not exposed to computer science opportunities. There are old stereotypes and a fundamental lack of understanding about the importance of computer science in today's job market. Students who pursue a non-computing STEM career are not taught that computer programming skills are now foundational in industries such as healthcare and manufacturing. Computing skills are also essential in non-traditional STEM or non-STEM fields such as social science research, architecture and design, and public policy.
  - i. To address this, Microsoft recommends increasing and strengthening public-private partnerships.
    1. School and business leaders need to better demonstrate the job opportunities computer science can open up.
    2. Students need to be exposed to computer science in the classroom, through visits from industry professionals, and through work-based learning experiences.
2. Teachers lack the professional development resources needed to instruct computer science courses.

- i. Microsoft's TEALS program, which stands for Technology Education And Literacy in Schools, helps to address this challenge by introducing industry professionals into classrooms to co-teach computer science courses with teachers. Microsoft also has programs to further teacher professional development in this area.
- 3. As of June 10, 2014, 28 states do not count computer science courses as a math or science credit toward high school graduation; instead, they are considered an elective much like ceramics or woodworking. In many states, AP Art History will count toward high school graduation requirements, but AP Computer Science will not.
  - i. Microsoft has been working with policymakers, advocacy organizations, business and community leaders, teachers and students to Make Computer Science Count across the U.S. Currently, 22 states and the District of Columbia count computer science as a math and/or science credit toward high school graduation. When computer science is recognized as a crucial STEM course, more students take it.
- 2. You state our poor record on producing math competency in our high school graduates and our dearth of computer science classes. Which is more important to fix first from your perspective?

**ANSWER:** Today's global economy and recent technological developments require teaching math and computer science hand-in-hand. Policymakers, business and industry leaders, teachers and students, and other community leaders all speak of the STEM skills gap and the need for more job candidates with computer programming skills. As stated in my written testimony, the Bureau of Labor Statistics has projected that there will be approximately 122,300 new job openings in the U.S. each year through the end of this decade in computing occupations requiring at least a bachelor's degree. However, in the U.S., only 50,000 students graduate each year with bachelor's degrees in computer science.

The jobs of today do not require just math or just computer science—employers want workers with both skills. Computer science is essentially an applied form of mathematics that is integral to industries outside of information technology, such as manufacturing, research (including non-STEM research), healthcare and defense. For example, thirty years ago, a graduate student in the social sciences did not necessarily need to know computer science in order to conduct research; today, he or she needs to understand programming languages and programs in order to successfully collect and analyze data. Today, a manufacturer on a factory floor operates very expensive and complicated machinery through a computer and needs to know which commands to give it. Computer programming is the language of today's industry and is just as essential as understanding statistics or calculus.

In order to ensure that our students graduate ready for the careers of tomorrow, both math and computer science need to be prioritized. That is why, as of June 10, 2014, 22 states and the District of Columbia have passed legislation counting computer science courses as math or science credits toward high school graduation. Now more than ever, fluency in a computer programming language is just as essential as understanding geometry or algebra in order to succeed in today's global economy. Computer science courses teach competencies such as algorithmic problem-solving, data analysis, and real-world problem-solving. Like math, computer science courses also teach logic and reasoning skills that is foundational across all industries.

**The Honorable Jan Schakowsky**

- 1. Women have historically been underrepresented in STEM fields, a disparity that continues today. This hurts women, because STEM jobs, on average, pay more. It also hurts families who rely at least in part on a woman's economic contribution to a household. And it hurts the country, because we senselessly end up with fewer STEM-knowledgeable workers than we otherwise would have. What

can U.S. corporations with significant numbers of STEM-related jobs, such as Microsoft, do to increase the number of women in STEM fields? What are the most important steps they can take?

**ANSWER:** The lack of women in STEM fields is extremely troubling. These statistics also impact productivity. For example, there is a 34 percent higher return on investment when women are included in leadership positions.

Microsoft focuses on four key actions to help bridge the gender gap:

- Reaching middle and high school girls with tools and programs;
- Partnering with key organizations and academic institutions;
- Raising awareness of the importance of events and mentorships; and
- Providing opportunities in computing.

I want to focus on Microsoft's commitment to middle and high school girls and to our partnerships. Microsoft believes that the courses a girl takes in middle and high school can play a key role in determining her path in college and beyond. Microsoft sponsors a number of technology tools and programs designed to show girls and young women the power of technology and to inspire them to pursue computer science as a career. For younger students, Microsoft offers fun coding experiences through competitions like KoduKup. Kodu is a visual programming language made specifically for creating games. Microsoft manages DigiGirlz programs where high-school aged girls learn about careers in technology, connect with Microsoft employees, and participate in hands-on computer and technology workshops.

For older students, Microsoft helps match students' skills with the needs of local businesses through its Students to Business (S2B) program. Older high school students and students pursuing post-secondary degrees can experiment with coding and game design by downloading professional Microsoft developer, designer and gaming software at no charge. They can also compete in Imagine Cup, which is the world's most prestigious student technology competition, bringing together 300,000 student innovators from all over the world.

In addition, as part of our YouthSpark initiative, we have the TEALS program which stands for Technology Education And Literacy in Schools. TEALS places computer science professionals in high schools. Working side by side with in-service teachers, TEALS volunteers teach basic and Advanced Placement (AP) computer science courses. Today the TEALS program is operating at 70 schools in 12 states (AK, CA, DC, KY, MA, MN, NC, ND, NY, UT, VA, and WA). Currently, more than 280 volunteers will teach 3,000 students during the 2013–2014 school year alone.

Microsoft has also been heavily involved in making computing count. We are working with state policy makers to make sure that if a student takes an AP computer science class they receive a math or science credit, not an elective credit. As of June 10, 2014, only 22 states and the District of Columbia currently reward students who take computer science with a credit that will help them graduate from high school. We need to make sure there are incentives for students to pursue computer science and STEM.

**The Honorable Bobby Rush**

1. Please explain how urban schools – particularly those in communities of color – are working effectively with students as well as colleges and prospective employers to ensure that they understand the opportunities and rewards of obtaining STEM-related certificates leading up to college and/or high-skilled employment.

**ANSWER:** Many urban school districts have taken advantage of Microsoft's public-private partnership programs that include Microsoft's Corporate Citizenship program called YouthSpark; Microsoft Learning's program called IT Academy; Microsoft's TEALS (Technology Education and Literacy in Schools) program; and Microsoft Education's program called Partners in Learning. These programs offer a variety of services but share the underlying mission to incorporate career training and skills-building to students' every day learning.

The TEALS program in particular places computer science professionals in high school classrooms to teach basic and AP Computer Science courses. TEALS reaches students in all geographic locations and many urban schools, including those serving a large population of African American and Latino students, have taken advantage of this program. More than 280 volunteers have taught 3,000 students during the 2013–2014 school year alone. These programs promote hands-on learning and give students the opportunity to develop essential skills that can be taken further in other programs, such as dual enrollment partnerships with community colleges. In addition, the presence of industry professionals in their classrooms gives the students access to career mentors and opens up more opportunities for internships or work-based learning experiences.

**The Honorable Donna M. Christensen**

1. During the hearing, we heard that one reason for the lack of students preparing for manufacturing-related jobs was that manufacturing is simply not viewed as "cool." How can this be addressed, and what role can employers (like Microsoft) play in this effort? At the same time, for those students inclined to go into manufacturing jobs, how do we best communicate what types of skills and training are necessary – whether following a path of industry certifications or pursuing a 4-year degree?

**ANSWER:** At Microsoft, we understand that interest in computer science and manufacturing begins at a young age. Reaching K-12 students can best be achieved by introducing them to manufacturing through hands-on learning, afterschool programs and mentorship programs with industry professionals. An example of these programs is the FIRST Robotics Competition. When we encourage students' interests, and make learning relevant, I think we begin to make it "cool."

FRED UPTON, MICHIGAN  
CHAIRMAN

HENRY A. WAXMAN, CALIFORNIA  
RANKING MEMBER

ONE HUNDRED THIRTEENTH CONGRESS  
**Congress of the United States**  
**House of Representatives**  
COMMITTEE ON ENERGY AND COMMERCE  
2125 RAYBURN HOUSE OFFICE BUILDING  
WASHINGTON, DC 20515-6115  
Majority (202) 225-2927  
Minority (202) 225-3841

May 28, 2014

Ms. Sandra Westlund-Deenihan  
CEO  
Quality Float Works Incorporated  
1382 Payne Road  
Schaumburg, IL 60173-4525

Dear Ms. Westlund-Deenihan,

Thank you for appearing before the Subcommittee on Commerce, Manufacturing, and Trade on Friday, November 15, 2013 to testify at the hearing entitled "Our Nation of Builders: Training the Builders of the Future."

Pursuant to the Rules of the Committee on Energy and Commerce, the hearing record remains open for ten business days to permit Members to submit additional questions for the record, which are attached. The format of your responses to these questions should be as follows: (1) the name of the Member whose question you are addressing, (2) the complete text of the question you are addressing in bold, and (3) your answer to that question in plain text.

To facilitate the printing of the hearing record, please respond to these questions by the close of business on Wednesday, June 11, 2014. Your responses should be e-mailed to the Legislative Clerk in Word format at [Kirby.Howard@mail.house.gov](mailto:Kirby.Howard@mail.house.gov) and mailed to Kirby Howard, Legislative Clerk, Committee on Energy and Commerce, 2125 Rayburn House Office Building, Washington, D.C. 20515.

Thank you again for your time and effort preparing and delivering testimony before the Subcommittee.

Sincerely,  
  
Lee Terry  
Chairman  
Subcommittee on Commerce,  
Manufacturing, and Trade

cc: Jan Schakowsky, Ranking Member, Subcommittee on Commerce, Manufacturing, and Trade  
Attachment

## Additional Questions for the Record

Sandra Westlund-Deenihan

### The Honorable Lee Terry

- 1. You mentioned the specialized knowledge needed for your business, such as a welder who knows the science behind welding. Why isn't that something that can be taught on the job?**

There will always be a significant amount of on-the-job training for any position. However, regardless of the size of the operation, manufacturers share a widespread and common need for skilled workers, especially for those persons who want to build long-term careers in manufacturing. The credentialing process has become an invaluable tool to me as an employer in this industry. Credentials validate an applicant's proficiency and ability to perform the tasks and duties needed on my shop room floor at a quality standard. An applicant with certification tells me they are equipped with the skills and capabilities to become an active part of my operation from day one on the job. Further, Credentialing offers the ability and peace of mind to know we can communicate in the same language on job descriptions, needs between employer and employee. If you think about it, we credential doctors and lawyers every day. Why not manufacturers?

An applicant coming through my doors with National Institute of Metal Working Skills (NIMS) certification lets me know when that person walks onto my floor, he or she is able to hit the ground running with a basic understanding of the job – equipped with the skills and capabilities to become an active part of my operation from day one on the job; NIMS provides machining and metal forming credentials through post-secondary curricula. Assessments are scored against 24 NIMS national standards that are designed to specific skill and competencies. These are national standards – transferrable throughout the United States. The national NIMS standards are modular, thus permitting credentials based on specific metalworking processes and levels of competency. For example, there are eleven distinct credentials in Machining Level I; 52 NIMS credentials overall. The credentials enable the employer to assess candidates in those skills most applicable to our firm's needs and enable training institutions to measure program performance tailored to industry's needs.

On the job training is great—I encourage every employer to offer this to their teams. However, certifications and credentials verify a worker possess a certain level of skill sets, tested by an independent third party – a certain level of understanding and operational knowledge.

- 2. You testified that you have had good success in increasing the participation of underrepresented populations – particularly young women – in advanced secondary STEM classes. What has been key to inciting interest in these young people, particularly younger girls?**

Mentoring and exposure. Guidance Counselors and girls need to see other women succeeding in STEM fields to understand the opportunities. The personal interactions and examples are the most effective. It is amazing to learn how many girls have not been presented with the opportunity to gain exposure to STEM related fields – to consider a career in these fields. Exposing young women to the possibilities that exist for them within the manufacturing industry, and encouraging them along the way, can create amazing results. Connecting young women with successful women in STEM industries has inspired many students in my school district to get involved with STEM curriculum in their classrooms.

3. **You said that you once had to teach an employee how to use a ruler and tell time on an analog clock. That's pretty surprising. Outside of those, what are the most basic skills you find lacking that surprise you?**

Basic math and the importance of math accuracy, as well as general communication skills. I have some simple math problems I often utilize in my applicant screening process—basic adding and subtracting of fractions—and am shocked to see how many fail. Small mistakes can cause huge production errors on the shop room floor, so understanding how to measure, add, subtract, use fractions and other basic math skills is absolutely necessary.

4. **Your testimony states you cannot start a second shift because you are unable to find enough people with the “basic skills” necessary. Can you describe what you mean by “basic” skills – is it a high school equivalent math or science education – or something else?**

As I mentioned in my testimony, I've had to teach an employee how to use a ruler and tell time on an analog clock – these are basic skills. Showing up on time, calibrating equipment, understanding how to read calculations and fractions to understand how deep to make a cut or adjust a press... these are critical basic skills a worker needs. Also, being able to read and understand safety instructions required to operate machinery... and counting the correct number of floats that need to go in a customer order... these are the most basic understanding deficiencies I haven't often found missing from potential job candidates who have come through my door. It is not surprising to have applicants not know how to complete an application. A high school equivalent of math and science should meet the needs for basic entry level employment; higher technical training and certification that can be learned on the job or through certification processes provide an even greater value add to our industry for more advanced positions.

5. **STEM skills can be defined differently depending on who is asked. How would you define it?**

A basic understanding and workable knowledge of science, technology engineering and math at the equivalent high-school level; this includes basic analytic and problem solving skills in these areas of study as well. A standard level of core competencies in these subjects is a very fair ask—especially as we as a nation and struggling to remain competitive in the global marketplace.

**The Honorable Jan Schakowsky**

1. **One major challenge in promoting STEM is helping students understand why subjects involving math and science are relevant to their life and their future. It is much harder to convince high school students to study hard in STEM classes if those classes do not relate to the real world around them. It is also hard to convince college students or mid-career workers to seek out technical education in a STEM field if you cannot tell them where the job opportunities of the future are going to be.**

**Please list steps manufacturers can take, on a national and a regional level, to pool their knowledge and help schools, students, and workers better understand where the jobs will be in the future. Please also address what can they do to ensure administrators offer and students take the right courses for those jobs.**

On a national level I am a member of the National Association of Manufacturers (NAM) Task Force on Competitiveness and Workforce, a group of CEOs and senior executives from across the country appointed by the NAM's chair to take a serious look at the skills gap and determine the most effective policy and implementation goals for manufacturers. We should have recommendations completed by next fall.

I am also a Member of the Board of Directors for the Manufacturing Institute, which has identified specific credentials train to and verify that a potential candidate has the skills necessary for success in an advanced manufacturing environment. The Institute works with manufacturers and manufacturing organizations on the state regional and local level to promote use of these credentials in community and technical colleges across the country. This is a national effort that is most effective on the local level.

Current society messaging is geared towards “college ready”- if you’re not college ready you are at a loss. We need to change the messaging – there are great opportunities that exist within manufacturing – great paying, technically advanced positions are out there and needing to be filled; we need to showcase these opportunities as prestigious career choices. Post-Secondary institutions aren’t up to speed – this is another example of the importance in connecting employers with the local educational institutions to work collaboratively in building the workforce. Often times, college curriculum is not geared towards manufacturing students nor consists of the type of actual training needed for today’s worker. Employers need to partner with community colleges to develop a curriculum that meets employers’ needs and encourage government leaders to prioritize the need for post-secondary training for working adults and non-traditional students. We need to see more public private partnerships being developed to establish learning opportunities – and ensure applicants are properly equipped with the needed skill sets to succeed.

From the perspective of Quality Float Works, Inc., I remain constantly engaged with my local school district as much as I can to increase communication about the type of skills needed for a rewarding career in the field of manufacturing. As I mentioned in my testimony, this personal engagement has been very successful.

- 2. Women have historically been underrepresented in STEM fields, a disparity that continues today. This hurts women, because STEM jobs, on average, pay more. It also hurts families who rely at least in part on a woman’s economic contribution to a household. And it hurts the country, because we senselessly end up with fewer STEM-knowledgeable workers than we otherwise would have.**

- a. How can manufacturers increase the number of women in STEM fields? What are the most important steps they can take?**

In 2013 the Manufacturing Institute released a report titled “Untapped Resource: How manufacturers can attract, retain, and advance talented women.” They surveyed over 600 women in manufacturing, across functional roles and levels, to gain their perspectives on how effectively their companies recruit, retain and advance women—and also conducted one-on-one interviews with women in a range of roles from senior leadership to individual contributors to gain their insights on human capital and talent development in the manufacturing industry. The results of that survey were clear. The lack of women in manufacturing is creating a lack of women in manufacturing. Women want to see leaders and mentors within their company so they know they see they too can succeed. They also want to have a clear idea of their career pathways, so they are aware of what skills they need to build to move to the next level.

- b. I understand that in 2011-2012, you served as Chair of the Illinois State Board of Education’s Gender Equity Advisory Committee, where you worked to equal educational opportunities to pursue high-wage, high-skill occupations. Please discuss the work of this panel in greater detail. What can be done at the state level to increase the number of women in the science, technology, engineering, and mathematics fields?**

I was appointed to serve as Chair Illinois State Board of Education’s (ISBE) Gender Equity Advisory Committee (GEAC) from 2011 – 2012, and was reappointed for second two-year term as Chair through 2014. The Advisory Committee serves as great partner to ISBE in partnering with groups and projects throughout Illinois to ensure the best information makes its way back to ISBE, including policy initiatives and programs, processes and best laid plans are considered before the Board.

In September 2013, for example, our board shared an informative and thought provoking study conducted by the American Association of University Women (AAUW) and the National Science Foundation (NSF) with ISBE, “Why so Few? Women in Science, Technology, Engineering, and Mathematics.” The study provides a valuable resource through outlining current hurdles as well as possible resolutions for moving forward and turning the tide. One size doesn’t fit all; methods and messages used to attract and support females in STEM studies and jobs needs to be carefully considered. Our Advisory Committee believes the report is a useful tool for so many partners. We believe it can be helpful as a compliment to the developing a STEM Learning Exchange and other ISBE STEM initiatives.

The GEAC believes greater access, equity and diversity produce higher achieving learning environments. The lack of women engineers and other female Science, Technology, Engineering and Math (STEM) professionals indicates intellectual capital is being left behind. An innovative action plan is critical to developing a strong workforce for the next generation; this can be addressed by enacting forward thinking solutions.

- 3. We know preparing our youth with the skills to excel in the jobs of tomorrow is crucial to maintaining U.S. competitiveness. However, there has been a lot of disagreement over whether or not the U.S. is actually facing what’s known as a “skills gap” in the STEM fields of science, technology, engineering, and mathematics.**

**At the Subcommittee hearing on November 15, 2013, you indicated that the “skills gap” is a constant challenge for your company. And if I understand you correctly, it is most acute in what is often called “middle-skill” jobs, like welders or machinists – because you need someone who understands the science behind their job, and ideally is credentialed. Your testimony concluded that the best way to close the skills gap is for manufacturers and industry leaders to engage personally in the solution and partner with schools. Can you describe what specifically you believe that engagement should look like?**

Personally, I am engaged on many levels. For the past three years, I have worked with NAPE-EF in collaboration with my local school district to secure funding through a grant program sponsored by Motorola Solutions Foundation’s Innovation Generation program. Our public/private partnership was awarded \$50,000 to fund the STEM Equity Pipeline – a program to engage administrators, counselors and faculty from five area high schools in intensive professional development to increase access, success and post-secondary transition of girls and other underrepresented groups in STEM. We have had great success in our first few years—results show a significant increase in advanced placement (AP) STEM testing and an increase of females enrolling in AP chemistry and math. Technical education enrollment also rose heading into this last school year as well as overall interest in nontraditional STEM-related careers after graduation.

In addition I am on the Board of Directors for the Manufacturing Institute, which has identified specific credentials training verify that a potential candidate has the skills necessary for success in an advanced manufacturing environment. The Institute works with manufacturers and manufacturing organizations on the state, regional and local level to promote use of these credentials in community and technical colleges across the country – catering the credentials to the local workforce needs. This is a national effort that is most effective on the local level.

Overall, efforts should include engaging further into training and collaboration with our local community colleges - employers and community colleges should work together in identifying, educating and employing a workforce that may not necessarily come from a traditional four-year university.

Often times, college curriculum is not geared towards manufacturing students nor consists of the type of actual training needed for today’s worker. In the end, employers will benefit and ample skilled candidates will be available to fill skilled positions if there is greater collaboration. Through educating our workforce and empowering

them to take control of their careers, I've seen my employees, who come from a wide variety of backgrounds, achieve a level of personal and professional success they never dreamed was possible.

Fast-tracking is another important piece of the puzzle in advancing the credentialing initiative. Employers need to "fast-track" workforce development by putting our own resources into training, partner immediately with community colleges to develop a curriculum that meets employers' needs and encourage government leaders to prioritize the need for post-secondary training for working adults and non-traditional students. We need to see more public private partnerships being developed to establish learning opportunities – and ensure applicants are properly equipped with the needed skill sets to succeed. Finally, School-to-Work programs work better than many realize - the principles, practices and service-delivery structure these programs provide can make all the difference in a young person's life and their path to enter the workforce.

### **The Honorable Bobby Rush**

- 1. Please explain how urban schools – particularly those in communities of color – are working effectively with students as well as colleges and prospective employers to ensure that they understand the opportunities and rewards of obtaining STEM-related certificates leading up to college and/or high-skilled employment.**

Beginning in 2011, I worked with the National Alliance for Partnerships in Equity Education Foundation (NAPE-EF) in collaboration with Illinois School District U-46 to develop a grant application for the *Innovation Generation* program run through Motorola Solutions Foundation, the charitable arm of Motorola Solutions, Inc. Through our collaborative efforts, our public-private partnership was awarded \$50,000 to fund the STEM Equity Academy - a program to engage administrators, counselors and faculty from five area high schools in intensive professional development to increase access, success and post-secondary transition of girls and other underrepresented groups in STEM. Over the past few years, we have built on our Program Improvement Process for Equity in STEM™ (PIPE-STEM) - a data driven decision making process where schools conduct an equity performance gap analysis, conduct root cause research to determine barriers students are facing that are causing the gaps, and implement research-based strategies proven to close the gaps.

The U-46 district is the second largest public school district in Illinois with 40,784 students. More than 63% of the student population is minority, more than half from low-income households and more than 100 different languages are spoken in the homes of U-46 students. Today, U-46 offers a wide array of STEM education programs at the high school level including honors and AP math and science courses as well as pre-engineering programs such as computer science, electronics and Project Lead the Way (PLTW). Consistent in all these courses is an under-representation of girls.

In the first year, results showed a significant increase in placement (AP) STEM testing and increase of females enrolling in AP chemistry and math. There was also a raise in technical education enrollment and an increased interest in non-traditional STEM-related careers after graduation. Overall, the districts female enrollment in Project Lead the Way, a pre-engineering program offered to high school students, increased from 125 females in 2010-11 to 191 in 2012-13. Female enrollment in AP Physics doubled (20 females) in the district from the baseline year of 2010-11 to 2012-13 (40 females). Female enrollment in AP Calculus increased from 189 in 2010-11 to 311 in 2012-13.

Working in collaboration with partnerships between the private sector and local school districts that can benefit by these grant partnerships is the most practical and beneficial vehicle to help achieve everyone's goals. Building similar efforts across the U.S. will be imperative to building a sustainable training program for the next generations of students and educators. Continuing to engage in grant partnerships like we are doing in my area with U-46 is a great model for tapping into resources and opportunities at the local level to plan seeds that will continue to grow for years to come.

The Honorable Donna M. Christensen

1. **During the hearing, we heard that one reason for the lack of students preparing for manufacturing-related jobs was that manufacturing is simply not viewed as “cool.” How can this be addressed, and what role can employers (like Microsoft) play in this effort? At the same time, for those students inclined to go into manufacturing jobs, how do we best communicate what types of skills and training are necessary – whether following a path of industry certifications or pursuing a 4-year degree?**

In a 2012 study on the public perception of Manufacturing 90% of respondents stated that manufacturing is “important” or “very important” for America’s economic prosperity and standard of living, but only 35 percent of Americans say they would encourage their children to pursue careers in manufacturing; this is problem. I’ve been invited to numerous speaking events/panels asked to address the state of manufacturing – most students/parents do not understand the opportunities that exist within manufacturing. Businesses partnering with local schools – inviting the students and their parents into their shops to see first-hand the types of positions and the environment opens the eyes of many; the messaging needs to be more wide-spread.

Quality Float Works was featured over the summer in an article by *the Chicago Sun-Times* sharing real information about the opportunities, positions and salaries that exists within manufacturing – opportunities for millennials who may not have a college degree but have a desire to learn a trade/skill. After the story ran, we were inundated with more than 100 calls/e-mails from folks wanting to learn more; inquiring about possible positions within our company. **No ‘want ad’ we have ever placed generated that much interest** – it is clear we as manufacturers have not doing the best job in communicating the wonderful opportunities that exist within the field of manufacturing. That said, the NAM and the Manufacturing Institute are currently partnering with manufacturers and other stakeholders to address the misperception of manufacturing in the eyes of students, parents, educators and the general public. A few great examples of these efforts include:

- **Dream It. Do It.** - Dream It. Do It. is the national career awareness and recruitment program for manufacturers. It includes national and local activities to engage, educate and employ the next generation of skilled manufacturing talent. In Illinois, the Illinois Manufacturers’ Association (IMA) purchased the state license for the program this year and is doing an advertising campaign involving the Chicago Bears to help draw attention to the program – we need to do more initiatives to get our message out to the mainstream population to draw interest to the great things a career in manufacturing has to offer.
- **Manufacturing Day** - On the annual Manufacturing Day, manufacturers open their doors to their communities. By hosting plant tours and other engagement activities, manufacturers expose students, parents, teachers, guidance counselors, and the general public to opportunities and realities of today’s manufacturing industry. Last year more than 800 sites participated in Manufacturing Day and we are hoping to increase that participation to over 1000 sites this year.
- **Internships** - Internships are a necessary component to this – we haven’t done a good job communicating the information about career pathways in manufacturing. Post-Secondary institutions aren’t up to speed – this is another example of the importance in connecting employers with the local educational institutions to work collaboratively in building the workforce.

Current society messaging is geared towards “college ready”- if you’re not college ready you are at a loss. We need to change the messaging – there are great opportunities that exist within manufacturing – great paying, technically advanced positions are out there and needing to be filled; we need to showcase these opportunities as prestigious career choices.

FRED UPTON, MICHIGAN  
CHAIRMAN

HENRY A. WAXMAN, CALIFORNIA  
RANKING MEMBER

ONE HUNDRED THIRTEENTH CONGRESS  
**Congress of the United States**  
**House of Representatives**  
COMMITTEE ON ENERGY AND COMMERCE  
2125 RAYBURN HOUSE OFFICE BUILDING  
WASHINGTON, DC 20515-6115  
Majority (202) 225-2927  
Minority (202) 225-3641

May 28, 2014

Mr. Lazaro Lopez, Ed. D.  
Associate Superintendent  
For Teaching and Learning  
Township High School District 214  
State of Illinois  
2121 South Goebbert Road  
Arlington Heights, IL 60005

Dear Mr. Lopez,

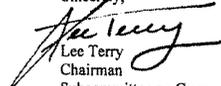
Thank you for appearing before the Subcommittee on Commerce, Manufacturing, and Trade on Friday, November 15, 2013 to testify at the hearing entitled "Our Nation of Builders: Training the Builders of the Future."

Pursuant to the Rules of the Committee on Energy and Commerce, the hearing record remains open for ten business days to permit Members to submit additional questions for the record, which are attached. The format of your responses to these questions should be as follows: (1) the name of the Member whose question you are addressing, (2) the complete text of the question you are addressing in bold, and (3) your answer to that question in plain text.

To facilitate the printing of the hearing record, please respond to these questions by the close of business on Wednesday, June 11, 2014. Your responses should be e-mailed to the Legislative Clerk in Word format at [Kirby.Howard@mail.house.gov](mailto:Kirby.Howard@mail.house.gov) and mailed to Kirby Howard, Legislative Clerk, Committee on Energy and Commerce, 2125 Rayburn House Office Building, Washington, D.C. 20515.

Thank you again for your time and effort preparing and delivering testimony before the Subcommittee.

Sincerely,

  
Lee Terry  
Chairman  
Subcommittee on Commerce,  
Manufacturing, and Trade

cc: Jan Schakowsky, Ranking Member, Subcommittee on Commerce, Manufacturing, and Trade  
Attachment