U.S. HOUSE COMMITTEE ON SCIENCE, SPACE & TECHNOLOGY
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Summary

As stated in the Presidential Executive Order Expanding Apprenticeships in America, the American Education System and Workforce Development Programs are in need of reform and federal investment. Over the last 20 years, the United States has experienced a shift from career and technical programs taught in high schools to college prep. Although this shift has resulted in more opportunity for students to gain a head start in earning a college certificate or degree, the elimination of career and technical programs has resulted in a workforce shortage in many career and technical fields. This shortage most impacts the high-level technicians. An example of this would be cybersecurity analyst, electrical system engineers and several technical positions in the manufacturing sector.

Moraine Valley Community College received a National Science Foundation/Advanced Technological Education Program (NSF/ATE) grant award in 2003 to study the cybersecurity workforce needs. The grant specifically funded our research of the nation's academic capacity to address the growing shortage of highly skilled cybersecurity professions. I currently serve as the Principle Investigator and Director for the Center for Systems Security and Information Assurance (CSSIA). Over the last 15 years, the National Science Foundation has funded our Center to identify barriers institutions face in developing quality cybersecurity technician programs. Our research has continually identified five major barriers institutions face in trying to meet the nation's capacity for cybersecurity professionals. These barriers include:
- Relevant and up to date curriculum
- Faculty shortage and faculty credentials
- Safe environments and laboratories for students to use the tools of the trade
- The establishment of effective apprenticeship programs
- The ability to diversify students in cybersecurity programs

The funding has enabled our Center to train over 6,000 K-12 and college faculty and provide instructional content that reflects the changing skill sets and knowledge required of today's cybersecurity technician. The CSSIA Center has developed over 400 labs that reflect current tools and technologies required of today's cybersecurity workforce. The Center distributes these labs to over 370 schools across the nation through our web portal. The Center also operates a virtual teaching and learning center that enables students to use real tools in a safe environment without impacting their institutions production network. The Center has also worked with organizations like The Association of Computer/ Information Sciences and Engineering Departments at Minority

Institutions (ADMI) in an effort to build their cybersecurity program capacity and produce more minority and women professionals in the cybersecurity workforce.

My experience in working with business partners that serve on our institutions advisory committees is that these positions are critical to our nation's economic strength. Our business partners recognize the need to re-establish strong career and technology programs both in the high school and community college system. There are several examples in which businesses are working closely with academic institutions to develop standalone apprenticeship programs designed to attract talented individuals to fill the type of technical positions in the highest demand. An example of such programs would include *Steelworkers of the Future*.

Steel companies dismantled their apprenticeship programs decades ago, but ArcelorMittal put a new spin on the old ways when a maintenance technician shortage was critical to their U.S. operations. *Steelworkers for the Future* has been around since 2007. That was when the steel industry emerged from years of consolidation and plant closings. The technicians who repaired and built machines, who could weld together a replacement parts on a dime or troubleshoot a communication glitch between machinery, were retiring and no one had the training to replace them in this very specific and complex job.

The steel industry realized they were losing in excess of 200 experienced mechanics and electricians per year. At this rate, the retirement of skilled individuals was beginning to impact their ability to maintain current production needs. ArcelorMittal developed a curriculum with partner colleges that includes coursework in welding, metallurgy, physics, hydraulics and pneumatics, as well as a sprinkling of liberal arts classes. During their two years of schooling, students who qualify for the program can take up two eight-week internships at their local plant, essentially working alongside an experienced technician as an apprentice. This experience changed the perception of students of the current work environment for the modern steel worker.

During their schooling and their apprenticeship, candidates are not yet employees. To make it through the hiring process, they are required to complete their studies and pass an entrance exam, which they can take during their apprenticeship. This apprenticeship offers $20.40 an hour for a 40-hour week. The average pay for technician jobs is $90,000 annually.

TESTIMONY

I am here today to share my knowledge and opinion of how apprenticeship programs, internships and residencies can address the growing gap in workforce needs and our nation's capacity to prepare students for these positions. I would like to share four potential approaches to increasing the quality and participation rate of apprenticeship programs in technological areas like cybersecurity.

Career Awareness

Over my 30 year career, the one area of workforce development I have been most involved in is the study and implementation of effective programs to increase student awareness in current critical technology fields. The majority of research in the area of student career awareness reflects that the absence of formal career awareness programs in our academic institutions result in greater shortages of students pursuing careers in technical programs. Both as a professor and resource center principle investigator, I have led teams in developing new and innovative career awareness programs. These programs present students with a self-directed opportunity to explore interesting career and technical jobs. The exploration also requires students to examine the typical roles and responsibilities associated with each position. These programs also provide a review of national resources that define typical salaries, job credentials and potential career pathways. One of the programs developed by the Center has been adopted by the Cisco Networking Academy. Last year, the course was used in over 4,000 classrooms and exposed thousands of students to potential careers that otherwise might not have been an option. This is just one example, however, there is a need or more national efforts to increase career awareness for students in K-12 institutions.

Increasing Business Investment and Apprenticeship and Internship Opportunities

Another important aspect of building effective cybersecurity programs is partnering with local businesses and organizations to build local apprenticeship and internship programs. Moraine Valley Community College has been successful in building these partnerships in which local businesses benefit from a continuous pool of qualified applicants and students who are able to gain experience and learn workforce skills that are difficult to replicate in the classroom. One example of a successful program would be the partnership between Moraine Valley Community College and ESPO Systems. This partnership represents the potential impact of well-designed apprenticeship programs. In the fall of 2017, Mr. Nick Stricker, a ESPO Systems representative, was nominated for the Illinois Community College Trustees Association Business/Industry Partnership Award. For a number of years ESPO Systems has hosted 32 student interns, 16 of whom have been hired as full-time employees.

Representatives from both ESPO Systems and Moraine Valley were focused on building an internship program that provides students with a meaningful and relevant workforce experience. This could only be achieved if both partners agreed upon the foundational skillset required for students entering the internship program. ESPO Systems and Moraine Valley representatives agreed upon a pathway to prepare students to gain the greatest benefit from their internship

experience while providing real value to the employer. This model has proved to be successful in that many of the intern participants have gone onto become full-time employees of ESPO Systems or one of their client's businesses. The result is each semester new opportunities are created for student internships.

ESPO Systems and Moraine Valley staff meet each semester to plan, review and evaluate the internship program. In addition, ESPO Systems serves on the Employer Advisory Committee. They also sponsor college events and student competitions.

Establishment of Industry Sponsored/Regulated Apprenticeships and Internships

As the rash of data breaches continue to make headlines, businesses have gained greater interest in working with academia and federal agencies in adopting national standards and recognizing schools that gain recognition from meeting the established standards. The National Security Agency and Department of Homeland Security established the National Centers of Academic Excellence in Cyber Defense. This program establishes curriculum requirements, student learning assessments and a series of institutional requirements. The CAE-CD program has established a national benchmark to identify institutions that achieved excellence in operating cybersecurity programs. Moraine Valley Community College was one of the first five two-year colleges in the nation to receive this designation. The CAE-CD designation process would serve as a great mechanism to expand quality apprenticeship programs for the cybersecurity industry. The program requirements could be expanded to require and recognize model apprenticeship programs. This program provides needed resources and funding that could be used to invest in building a national network of cybersecurity apprenticeship programs.

Establishing National Credentials Directly Linked to Participation in Internships and Apprenticeships

Based on my experience in working with academic institutions that teach cybersecurity programs, I believe there is strong support for the establishment of a national credential that would be directly linked to student's successful completion of a recognized apprenticeship or internship program. Many other industries that require practical technical skills have established these types of apprenticeship credentials. There are many examples of these credentials in the medical field. The cybersecurity industry is well organized to adopt a similar program that could be directly associated with one of the two national programs that are operated by federal agencies. CyberCorps (R): Scholarship for Service (SFS) is a unique program designed to increase and strengthen the cadre of federal information assurance professionals that protect the government's critical information infrastructure. This program provides scholarships that may fully fund the typical costs incurred by full-time students while attending a participating institution, including tuition and education and related fees. The scholarships are funded through grants awarded by the National Science Foundation (NSF). This program could leverage current internship opportunities with a nationally recognized credential that students could earn by successfully completing an apprenticeship or internship program with a federal, state or local government agency. The

NSA/DHS CAE-CD program could also be used to expand a nationally recognized credential earned by students participating in recognized apprenticeship programs in the private sector.

Concerns Associated with a Nationally Recognized Apprenticeship Credential

The establishment of a national apprenticeship program with nationally recognized credentials would need to be designed so that no potential student is left behind and that the program would be made available to all citizens regardless of age, sex, race and other factors. There are many successful examples of apprenticeship program in Europe and Asia that have been very efficient in meeting workforce demands but have resulted in older citizens being locked out of potential apprenticeship opportunities. The rigidness of these programs creates a one-shot opportunity for students to participate and those that miss this opportunity have little chance of ever participating in the program afterwards.

The Role of Community Colleges

As a 30 year employee of the community college system, I would like to highlight the unique role community colleges can contribute to establishing a better national network of apprenticeship programs. Community colleges as the name indicates belong to and serve their local community. Students attending community college programs are looking for an inexpensive and efficient pathway to new careers and academic opportunities. Community colleges provide their local communities with the nurses, health care workers, heating and air conditioning technicians, automotive technicians, information technology specialists and cybersecurity specialists to name a few. Community colleges have close relationships with the career and technology programs at their local high schools and can provide students with an early awareness of career opportunities in technical fields. Many of the adjunct faculty that teach at community colleges come from the local workforce. These individuals enable community college career and technical programs to build strong partnerships with our local businesses. Any expansion of apprenticeship opportunities should leverage community colleges and their unique position within communities across the nation.