

Cybersecurity Education:

Meeting the Needs of Technology Workers and Employers

Full Committee Hearing

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Good morning Mr. Chairman and members of the committee. My name is Sydney Rogers and I am Vice President of Community and Economic Development at Nashville State Technical Community College (NSCC) in Tennessee. NSCC is located in an urban area and serves a student body of approximately 7000 racially diverse students including approximately 26% African American. The average age of an NSCC student is 30 years. Many of our current students are already in the workforce and attend NSCC to acquire new work skills, some enter the workforce directly or transfer to Tennessee State University, a Historically Black College or University (HBCU) located less than 5 miles from our campus. Many others transfer to Middle Tennessee State University (MTSU), in Murfreesboro, Tn., or Austin Peay State University (APSU), in Clarksville, Tn. For nearly a decade, Nashville State Community College has led a regional effort to transform Information Technology education. The Advanced Technological Education (ATE) program of the National Science Foundation (NSF) has funded these activities. Our partners include the regional universities just listed above, local school systems, and dozens of business partners such as Saturn, BMI, Dell Computer, EDS, Hospital Corporation of America (HCA), and Vanderbilt University Medical Center, among others.

Today we examine the challenge of educating skilled workers within the context of a world that is vastly different from the world when I began my career 30 years ago. My colleagues and I believe it is important to understand this new context in order to adequately understand what is needed to design and implement education programs that will develop a world-class competitive workforce, with respect to cyber security. The context of today's educational programs involves new and constantly evolving technologies that are dramatically changing every aspect of our society. New threats, such as terrorism and identity theft pose even greater security challenges while the distributed nature of systems and data storage complicates the control of security exponentially.

Our response from a technical perspective has been to mitigate these exposures as much as possible through techniques such as patches and virus protection software and then reduce the exposure to risk with technologies like firewall protection and encryption. As a result, we find ourselves addressing the symptoms and not the real problem; systems designed and built without consideration of security. Technicians work on individual problems without an overall context. One Chief Network Officer in Nashville explains it this way, "We are fixing the symptoms because we are dealing with legacy systems and our only solution is to fix the symptom".

Education's response today is to focus technician education on training for specific technical skills through certification programs, expansion of course content, addition of

new courses, new concentrations, and new two- and four-year degrees and this slide shows some of the programs we are doing at my college and others in Tennessee. All of

these approaches are necessary in order to protect today's systems, but how do we educate today for tomorrow's cyber risk? How do we build a workforce that will know how to use what they know in context and that will have the skills necessary to understand constantly changing technologies and what is needed to both use and protect them?

Our industry partners in Tennessee tell us, as depicted here; cyber security professionals who require the most extensive technical knowledge also represent a relatively small number of workers who need specific highly technical cyber security skills. To be sure, all information technology professionals must possess the technical skills necessary to develop and maintain secure systems. Our employers tell us that all workers need some understanding of cyber security and some level of expertise in these skills. Even though community colleges and our NSF work touch all three of these areas, our ATE focus is in the preparation of IT professionals.

To meet today's need and at the same time build a workforce that meets tomorrow's needs, we must move beyond traditional curriculum development methods that focus on silos of content with little context. We need to develop teaching and learning methods that foster learning, thinking, and problem solving in the context of the real world. Not only do workers need to know how to use their knowledge "in context", but educational research has shown us that such methods produce great improvements in learning and that students prepared in this way more easily transfer what they know to new and different situations. My colleagues and I believe the ability to transfer knowledge more quickly will result in more adaptable workers who will be able to understand more quickly and apply changing technologies. The term the researchers use for this is "adaptive expertise". Through a previous NSF/ATE grant called (SEATEC- DUE 9850307), NSCC in conjunction with Saleh Sbenaty of Middle Tennessee State University (MTSU), conducted a research study that tested the theory that students would more easily transfer technical knowledge learned using problem based case studies than they would knowledge learned using traditional methods. Although we did not address cyber security directly in this study, we believe the concept of knowledge transfer is important in building a workforce that is cyber security competent. For more information about this study and the results please see the article by Dr. Saleh Sbenaty of MTSU in the Proceeding of the 2002 American Society of Engineering Education (ASEE) Annual Conference and Exposition. The community colleges in Tennessee have learned much about how to transfer this research in to practice through our NSF/ATE grants. In 1998, Gerhard Salinger one of the lead program officers of the ATE program introduced us to John Bransford from Vanderbilt University (now at University of Washington). Dr. Bransford is the one of the editors of the National Research Council's publication "How People Learn", an extensive collection of recent research on the subject. Working with him and his team of researchers, we have begun to transform the way we structure the learning environment. For information on how we have used this research to transform teaching and learning, see article in American Association of Community College Journal, October/November 2003 "Transferring Teaching and Learning Research to the Classroom" by Sydney Rogers and George Van Allen.

We have developed model programs for bringing these workplace experiences directly to the students and creating more adaptable workers. Our contextual and problem-based methods all share some common characteristics. First, they are all based on authentic workplace problems. To bring these authentic workplace problems into the classroom requires a close and consistent working relationship with our business and industry partners. Just as technology and the workplace are changing constantly, these authentic experiences must also change. By implementing these experiences for students we are also building a curriculum that adapts and changes with changing technology and situations. Using these methods, then, we can create an educational system that builds a closer link between the content taught and the actual workplace application while also developing workers who are more able to adapt the knowledge they have to a rapidly changing world. Finally, to effectively teach using these methods, faculty must learn to function as highly skilled facilitators who guide students to discover and understand the appropriate scientific and technical knowledge. (See our websites for case studies of some of these authentic problems. www.cite-tn.org and www.casefiles.org).

In Tennessee, the NSF/ATE projects have helped to develop a strong foundation for reeducating current workers and building programs for the future. For instance, we have just initiated a program with the Tennessee Telecommunications Association (TTA) to re-educate some of their workers. In a series of courses, including two courses on network security, our community college faculty will teach the TTA employees using the contextual and problem-based methods in the form of problem-based case studies and real-time problems. Our faculty would not have the skills and knowledge to do this if we had not had the funding from the ATE program to provide faculty development opportunities for them. Our NSF/ATE Center for Information Technology (CITE) sponsors an electronic marketplace for workforce development called the Tennessee IT Exchange. Employers and students can find out where to obtain education on the latest technologies, including cyber security. The community colleges in the region, Nashville State, Columbia State, and Roane State along with the regional universities, TSU, MTSU, and APSU, all contribute to the Exchange. The Tennessee IT Exchange may be viewed at www.cite-tn.org . CITE also partnered with the local workforce investment board to HIB-Visa funds to middle Tennessee for retraining in IT. A portion of this training will be on cyber security.

As for the future workforce in IT, we have piloted an exciting program that brings real-time industry technical problems directly into the classroom to be solved by students by partnering industry technicians with faculty at the community colleges and universities. Last year, some of these problems included a network security problem at a music company and a distributed data and networking problem for the Saturn Corporation. Results at both the community college and the university have exceeded expectations. For instance, Saturn and EDS worked with us on two problems, one at NSCC and one at Tennessee State University. Evaluations from students, faculty, and employers tell us that students are more engaged and learn better and Saturn is now considering implementing some of the student solutions at the plant. See attached description of this type problem solved by students at the DOE Y12 Security Complex in Oak Ridge, TN.

Last year and this year, CITE partnered with the Nashville Technology Council to sponsor faculty and student teams at the Technology Council's annual "IT Security Conference". At this conference, students' interaction with security experts and vendors provides a context for their learning. CITE is also helping to establish "IT Academies" in high schools across Tennessee to build a pipeline of students who will enter the workforce or college in technical IT careers. One such academy is located at Stratford High School, an inner city, mostly minority school in Nashville. It opened in the fall of 2003 with 97 students and 9 faculty members. Thus far, 57 additional students have applied to attend in the fall of 2004.

The concepts and projects I have highlighted have given us a fundamental knowledge base for educating cyber security workers as well as all workers who need to understand their work within the context of the needed security. The road that has brought us to this point required several years of work in faculty development, materials development, and building partnerships with business and industry. Others around the country have worked on similar concepts with slightly different approaches. Together and with the support of the NSF/ATE program, in two weeks we will convene more than 250 community college technological faculty and administrators, along with some of their industry partners, university partners, and secondary school partners in 31 teams from 17 states across the country in Nashville for "Synergy 2004" (DUE 0412846). At "Synergy", these teams will begin to develop plans for educational reform of IT and IT enabled programs in their own regions of the country. Their work will be anchored by presentations from leading experts in teaching and learning such as John Bransford, Jay McTighe, and Pam Tate. To provide the context and one global perspective, Doug Busch, the Chief Information Officer for Intel, will talk to us about the type of IT workforce we need to build if the country is to be competitive and to create jobs that will not be candidates to offshore. I expect Mr. Busch to confirm that we are on the right track with the reform programs we have started. In an interview Mr. Busch recently provided for us, he states, "One of the key problems we see as private sector participants trying to contribute to improved education is the lack of a central focus for U.S. education. Reform of technical education is so fragmented in the United States that it often seems impossible to have a significant positive impact. This is very different from the situation in the countries the United States competes with. I believe it would be very useful to have a single focus point". Several colleges and universities around the country have collaborated to produce "Synergy". They are Nashville State Technical Community College in Nashville Tennessee, University of Arkansas at Fort Smith, University of Massachusetts in Boston Massachusetts, Springfield Technical Community College in Springfield Massachusetts, and Bellevue Community College in Bellevue Washington. Please see www.synergy2004.org for a complete description of the meeting.

We also expect those who attend "Synergy" to leave motivated and prepared to begin to implement meaningful change. They will need to be supported in their efforts and I believe ATE program is looking for ways to do that. As I have explained, to be successful, these community colleges will need to be closely aligned with their business,

industry, and government employers who will rely on the future workforce. Although our program and others have been successful in partnering with business and industry, doing so remains a barrier to many programs. Many small businesses cannot donate the needed

time and resources to our efforts. Therefore, government programs that provide incentives for business and industry participation with community colleges would benefit all concerned. Too, initiatives that provide opportunities for faculty and students to participate in real-world internships will further support these efforts. Also, the educational infrastructure in this country as it is currently structured creates “silos” of educational programs. To make real and substantial progress, we will need incentives to break down these barriers so that we can begin to build an education system for the future; one in which cyber security is a fundamental part of the context and the outcome. And, the government’s continued support of the ATE program so that the necessary materials development, faculty development in teaching and learning, and up-to-date technical knowledge can occur will be vital to the success of these colleges. Finally, to achieve the best result, technological education should be made a national priority. Thank you for the opportunity to give you this information about our programs.