NATIONAL CYBERWATCH CENTER

Innovations in Cybersecurity Education

2017

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Message from the Director

National CyberWatch is committed to providing a robust collaboration platform to all our stakeholders that builds on our collective strengths and creates an informed community of interest in cybersecurity education. A symbol of this commitment is the launch this year of our annual Innovations in Cybersecurity Education program.

Forty-four submissions were received and reviewed this Spring by a panel of peers, and five uniquely creative ideas were selected for special recognition at the 2017 Community College Cyber Summit (3CS). All submissions form the foundation of a treasure trove of ideas that will ensure that the proverbial wheel stops being reinvented, that creative ideas are celebrated, and that cybersecurity education moves forward with confidence.

Additional programs of impact will be emerging from our Center in the months to come - take advantage of each and every one, and pass on the excitement!

Sincerely,

Casey W. O'Brien
Executive Director & Principal Investigator
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Prince George's Community College

Message from Membership

Time is probably one of our most valuable assets, but spending it in ways that enhance what we do is not always easy to add to our maxed-out professional lives. In the coming year, the National CyberWatch Center will be focusing on capturing, packaging, and delivering information that will help you in your role as a developer of the next generation of America's cyber-savvy workforce.

The Innovations in Cybersecurity Education program is just one way in which the National CyberWatch Center is collecting the descriptions of novel approaches and innovative techniques, and broadening their impact way beyond one campus. This harnessing of the collective creativity across our cyber-education spectrum is positioned to become one of the leading functions of this Center. If your institution is not yet a member of the National CyberWatch Center, I urge you to consider taking that step, not only to have your school represented, but so that all faculty involved in cyber-education have a voice and a pathway to enhancing the effect of their own programs and innovations.

The leadership team of the National CyberWatch Center wishes to congratulate the authors of this year's submissions, published in this volume, and applaud their willingness to share their knowledge and new approaches with the cyber-community.

Congratulations, and best wishes,

Barbara J. Huffman de Belón,
Director, Membership

01

CURRICULUM

WINNING SUBMISSION:
CYBER WARRIOR PRINCESS CYBERHER EDUCATION FOR GIRLS

CYBER WARRIOR PRINCESS CYBERHER EDUCATION FOR GIRLS

CURRICULUM

DESCRIPTION

The research is overwhelming; there are not enough women in STEM, and specifically the cybersecurity field. Long enough had we sat back reading article after article and reviewing the research, so we decided to do something about it! Thus, the Cyber Warrior Princess (CWP) project was born! Some [really] smart women, and a few guys, got together and created this program, which uses a blended training environment and innovative, interactive learning material designed to educate girls from 6th-12th grades in cybersecurity by encouraging their strengths, comfortability, and confidence! CWP teamed with the Dayton Regional STEM School to create the first Chapter of Cyber Warrior Princess and the results were astonishing!

Students are introduced to cybersecurity in a way that leverages online gaming, art, and collaborative group research. We learned very quickly in our first pilot year that the students thrived when we related cybersecurity to their everyday lives, which have been immersed with technology since young ages. By doing this, the students felt like they were in control, and even more so, having fun, being creative, and engaging with one another – which is just what the cybersecurity career field needs: innovative thinkers, collaboration to ward off our adversaries, and a workforce who's excited for the challenges our nation and private sector industries face daily. Our goal is to be a community-driven, freely available platform, and we have created a community in which other organizations are encouraged to add modules to our Learning Management System (LMS), which can be made available to every participant and contributor.

CWP provides the flexibility and adaptability to work in a multitude of different environments. We have schools where students do not have internet connectivity and lab space, so we have developed an online lab environment that can be provided to the schools as a "lab-in- a-box" solution to be used locally. Pikes Peak Community College has partnered with us to provide a summer camp for girls in Colorado Springs, leveraging our program and adding their own specific curriculum. That curriculum will be added to the CWP program and made available to other users - a tremendous benefit of our open and free LMS.

BENEFITS

The CWP program provides free curriculum to schools, public centers, such as libraries, parents, and even to students directly; to be leveraged however best suited for their environment. Although the material has been created with a female student in mind, there are no restrictions to only female participants. This non-competitive, collaborative learning mode was created as a gateway into learning about the fundamentals of cybersecurity, while exploring the various career opportunities it provides.

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TRANSFERABLE

Yes, this innovation is transferable to other institutions.

DEVELOPING A NEW AAS DEGREE

CURRICULUM

DESCRIPTION

This AAS degree program consists of many core courses related to cybersecurity such as fundamentals of cybersecurity, information security, cloud computing privacy and security, cryptography, networks and network security, computer forensics, cryptography and web applications security, and a capstone course.

This program covers a wide spectrum of security topics that I have never see in any other two-year college's cybersecurity program.

This program helps prepare students acquire three certificates: Network+, Security+ and Systems Security Certified Practitioner (SSCP).

This program has a built-in idea of stackable curriculum, where students are able to either enroll in the AAS or any of the three aforementioned certificate programs. Students will have the flexibility to continue their education by transferring these courses to the AAS degree.

Also, future certificates will have some of the courses in the AAS degree plus other specialized certificates such as computer forensics.

BENEFITS

This will prepare students with a multitude of skills required by employers. Also, students will have the chance to take the exam for different certificates once they finish the required courses.

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Yes, this innovation is transferable to other institutions.

ACM COMPUTER SCIENCE TRANSFER CURRICULUM WITH INFUSED CYBERSECURITY CONCEPTS

CURRICULUM

DESCRIPTION

This ICE is a careful curriculum weave of computer science and cybersecurity education specifically designed for associate degree transfer programs. The Education Board of the Association for Computing Machinery (ACM) has endorsed the 2017 "Computer Science Curricular Guidance for Associate Degree Transfer Programs with Infused Cybersecurity" that was produced by the ACM Committee for Computing Education in the Community College (CCECC). An electronic version of the curricular guide will soon be published in the ACM digital library. The ACM is a global professional society with over 100,000 members worldwide (acm.org).

The development of this innovative curriculum followed an iterative process. Feedback on the initial draft from the first public review and comment period was processed to create the second and last draft. Likewise, the feedback from the last draft was processed to produce the final version of the curriculum. Over 50 community college and university computing and cybersecurity educators contributed to the creation of this forward-facing curricular guidance as one of the members of the CS-Cyber task force who met virtually in teams over the course of six months or through participating in a half day workshop at SIGCSE 2016 in Memphis, TN, stopping by the poster session at ITiCSE 2016 in Arequipa, Peru, or attending one of several sessions (affiliated event, poster and BoF roundtable) at SIGCSE 2017 in Seattle, WA.

In addition, two surveys provided valuable input, influencing the curricular guidelines. The first survey asked which knowledge areas and knowledge units from the ACM CS2013 baccalaureate body of knowledge were appropriate for the first two years of a computer science program. A second survey solicited input on cybersecurity content appropriate for an undergraduate computer science degree program in the first two years.

BENEFITS

The benefits of this innovation in cybersecurity education (ICE) include:

1. Providing associate degree curricular guidance from a well-respected professional society, the ACM, that blends computer science and cybersecurity education together.
2. Building a blended Body of Knowledge based on measurable student learning outcomes and assessment metrics.
3. Acknowledging the critical importance of cybersecurity education across a well-established computing discipline.
4. Providing an online correlation tool to determine how closely an associate degree program aligns with the ACM curricular guidance.
5. Sharing course and program examples with the broader cybersecurity education and computer science communities.

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TRANSFERABLE

Yes, this innovation is transferable to other institutions.

GLOBAL CYBER ETHICS AND EFFECTS ON CYBERSECURITY

CURRICULUM

DESCRIPTION

Graduate students seeking a certificate in Information Security Management are required to take four courses, one of which is Cyber Ethics, the course involved in this description.

Students were given a scenario in which they identified some type of fictitious U.S. company that was considering adding a work location in other countries. Each student selected countries of interest to them and reviewed a wide range of relevant information they found online. They identified issues that were important for their company and ranked each into a category. Their final product involved calculations and justifications for their final decision in their top two selected countries. Each student presented their findings to other class members and handled responses to audience inquiries.

BENEFITS

Students indicated that they learned a great deal about other countries' policies as to acceptable behavior and other information relevant to considering those locations as additional sites for their fictitious organization. In addition to their own results, they gained considerably from other students' reports. Students indicated that they retained much more of the information by searching for it themselves rather than from reading a textbook.

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TRANSFERABLE

Yes, this innovation is transferable to other institutions.

NEW CYBERSECURITY COURSE ITSY 1442

CURRICULUM

DESCRIPTION

The Information Technology Security course ITSY 1442 has been added to the Network Maintenance Technology degree and certificate courses.

BENEFITS

The course, instructed by certified instructors, will bring students to a new and higher level in the computer technology field by preparing them for Security+ certification and credit transfers to a four-year college for advanced training in cybersecurity. It also will allow better opportunities for job placement upon graduation.

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TRANSFERABLE

Yes, this innovation is transferable to other institutions.

TEACHING CYBERSECURITY USING GAMIFICATION AND HUMOR

CURRICULUM

DESCRIPTION

For my Risk Analysis and Compliance course, we have to cover a lot of dry material such as NIST 800-53v4. To create an atmosphere of humor and fun, I carved out a large part of the course lectures into student-led lectures. During the first class, I divided up the entire required reading among all students. I continued to provide context for the initial three classes. After that, all classes are led by students with me providing input and additional practical insights where appropriate. For each class, four students lead 30 minutes of discussion on a portion of the syllabus. They were rated on the humor they injected into the discussion and how they engaged their classmates.

Students found funny cartoons and animations to depict cybersecurity issues and concepts. They created games such as Cybersecurity Jeopardy, Cybersecurity Millionaire, Cybersecurity Bingo, and various other games. Some have engaged the entire class in play acting. They also were rated on their creativity in narration and their ability to share stories and examples related to their topic.

I divided the class into groups of about eight students. Each student applied class learning to write research papers on an organization of their choice. Each student picked a different organization on a first-come-first-served basis. They uploaded a draft for their respective peer group to read and provide constructive comments two weeks before the final due date of the paper. Students read all their peer group papers and provided constructive comments. Each student then took the feedback and rewrote the paper into its final form to be graded. Students then wrote a second paper with a comparative analysis of all organizations in their peer group with a set of recommendations for each organization. The second paper draft was also peer reviewed. Thus, students got to see a variety of ways to do a comparative analysis paper.

BENEFITS

Every student's work is improved because they are able to see a wide range of papers and styles of writing. Students internalize the material much better because they have to present. They also follow each presentation more closely to learn because they know they will have to present themselves. At the end of the class, students have two solid research papers and a presentation, which they can take to a job interview. Several students acquired jobs because they could show their tangible work. Students love the format of the class and appreciate how much they learned. I still get feedback from students who took this class and learned so well that they were able to apply that in their jobs immediately.

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No, this innovation is not transferable to other institutions.

OPEN EDUCATIONAL RESOURCES

CURRICULUM

DESCRIPTION

Increasing textbook costs continue to be a challenge for students. On top of tuition, students are expected to spend hundreds of dollars on textbooks despite the enormous amount of open resources available. I developed an introduction to security course utilizing open educational resources available on the Internet.

The course introduces IT Security concepts such as authentication, encryption and disaster recovery. The course also incorporates a cyber simulation software called Cyber Ciege and hands-on labs through Cisco. Many teachers still require students to read textbooks on a weekly basis. However, I researched and found videos and podcasts explaining security concepts, giving students another avenue to learn. The final project is a service learning project that teaches Internet safety to local middle school students.

BENEFITS

Through developing an open educational resource class, I am able to save students at least $150 in textbook costs. I diligently researched and vetted the online resources and plan to utilize websites such as Udemy, Cisco, oercommons.org, as well as free educational tools like Cryptool. This course syllabus is filled with links to videos discussing security topics, rather than requiring students to read a textbook each week. Other teachers can use my syllabus to implement in their classes.

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TRANSFERABLE

Yes, this innovation is transferable to other institutions.

AN INNOVATIVE CURRICULUM AND IMMERSIVE GAMEPLAY ACTIVITY FOR INTRODUCING CRYPTOGRAPHY AND SECURITY

CURRICULUM

DESCRIPTION

There is a recognized shortage of students who are interested in learning computer and network security. One of the underlying reasons for this lack of awareness and motivation to study the subject. In order to tackle this problem, we have developed an introductory cryptography and security curriculum that attempts to inspire students to pursue this career path.

Towards this end, the curriculum we have designed motivates the importance of the field and contains a variety of activities intended not only to teach students basic concepts, but also allow them to develop technical skills in a fun and engaging manner. In particular, we employ a novel set of Capture the Flag (CTF) exercises and a physical activity based on an urban race, both of which are tied into a fictional story that students act out. The storyline follows a book series that many young adults of this generation are familiar with:"Divergent" written by Veronica Roth. Using this approach, we have successfully delivered our curriculum at multiple schools throughout Oregon. Finally, we made all of the material for offering this curriculum publicly available to instructors wishing to use it at https://cyberd.oregonctf.org

BENEFITS

Our curriculum and activities provide an engaging first experience to students that allow them to cultivate interest, competence and confidence in pursuing a career in the computer security discipline. Feedback from students included: "It was really satisfying to figure out the hidden codes."; "I thought that it (the crypto curriculum) was extremely well put together and was equally challenging and fun."; and "The problem-solving and creativity part of this thread is something that everyone on our team enjoyed and appreciated." Feedback from teachers included: "Love the puzzle within a puzzle hook and motivator.... Students definitely got into this."; "The interconnectedness built into the progressive challenges was superbly handled, and the scavenger hunt was phenomenal!"; and "Well planned and implemented. My students were able to apply their knowledge and have fun."

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TRANSFERABLE

Yes, this innovation is transferable to other institutions.

STACKABLE CREDENTIALS WITHIN A DEGREE PROGRAM

CURRICULUM

DESCRIPTION

Metropolitan Community College (MCC) in Kansas City has recently redesigned a systems administration degree. The new program, AAS Secure Systems Administration and Engineering, is built around stackable certificates mapped to industry certifications. This program helps students earn credentials more quickly and offers credit by certification for students already holding credentials and wishing to complete a degree or certificate. Rather than simply having students complete the core requirements of a degree, the core is broken down into three separate credit certificates. Each certificate also has the requirement to complete one of the following CompTIA Certifications, respectively, A+ Network and Security+. Students are able to complete certificates and earn industry certifications while also satisfying the requirements of an AAS degree. There is no time wasted for students seeking the certifications or the degree. This innovation has been well received by area employers as well as our advisory board. Additionally, since the launch of the new degree, the AAS in its entirety now transfers to the University of Central Missouri for students wishing to complete a BS in Systems Engineering Management.

BENEFITS

Every institution has a goal to increase completion. We have students who get hired full time before they ever finish our program. That is good for them, but if they don't come back to finish their program we can't count that as a completion. We've also seen many students already working and with degrees who come back for updated courses. The core of the degree, broken down into stackable certificates, allows students to complete certain credentials more quickly. MCC prepares students to enter the in-demand information technology and cybersecurity fields by offering a program that blends current system administration concepts with essential security skills and best practices necessary to deploy, administer and harden computer and network systems.

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TRANSFERABLE

Yes, this innovation is transferable to other institutions.

IMPLEMENT A CERTIFICATE IN INFORMATION ASSURANCE TO PROVIDE FOCUSED CONTINUING EDUCATION FOR PROFESSIONAL ADULT STUDENTS

CURRICULUM

DESCRIPTION

Created a program for continuing education students that provides a focused program on information security. Five courses, aligned with five industry certifications, provide a student with well-rounded hands-on experience and education to give them an advantage in the market place. For each certification received, four non-transferable credits will be awarded so that students can also work toward earning an associate degree in Information Technology.

BENEFITS

By aligning the courses with industry-recognized certifications and national standards for educational excellence, students will have the confidence and experience necessary to make an immediate impact in their work environment. It also places these students in the enviable position of having the training and knowledge necessary to change and/or advance their careers in information security.

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TRANSFERABLE

No, this innovation is not transferable to other institutions.

CYBERETHICS CAREER DEVELOPMENT ONLINE COURSE

CURRICULUM

DESCRIPTION

This course exposes the student to the topic of cyber ethics, professionalism and career development. The course provides students seeking a career in cybersecurity insight on professional behavior required in a security job and how to develop a professional career in Cyber Security. The course includes developing a resume and understanding how to manage a career. The course is fully online and provides students with the following course objectives:

1. Understand the traditional ethical frameworks that can guide the student's analysis of the moral dilemmas and social problems that arise in cyberspace.
2. Describe and understand the directive and architectonic role of moral ideals and principles in determining responsible behavior in cyberspace.
3. Describe and understand the capacity of free and responsible human beings to exercise some control over the forces of technology.
4. Explain and understand the appropriate regulatory response to social problems that have emerged in the online world and formulate and apply answer to the idea that market forces handle social problems or that the government intervention is essential.
5. Understand and explain the bottom-up and top-down approaches to regulating the internet.
6. Describe and formulate the optimal approach and interaction of regulatory policy and technology.
7. Understand and apply career development processes and best practices.
8. Write a successful resume.

BENEFITS

Provide students with the necessary understanding and abilities to apply ethics in the cyberworld. This course prepares students to apply cyber ethics in the workplace and help further their careers. Provide students with an understanding of professionalism and career development in the workplace.

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TRANSFERABLE

Yes, this innovation is transferable to other institutions.

02

FACULTY DEVELOPMENT

WINNING SUBMISSION:
FREE E-BOOK FRAMEWORK FOR SCADA CYBERSECURITY

FREE E-BOOK FRAMEWORK FOR SCADA CYBERSECURITY

FACULTY DEVELOPMENT

DESCRIPTION

Based on the collaboration of INDUSOFT and Eastern New Mexico University - Ruidoso Branch Community College, Richard Clark and Stephen Miller co-authored this e-Book as a result of their participation in the NIST Cybersecurity Critical Infrastructure Framework Workshops Framework for Improving Critical Infrastructure Cybersecurity Version 1.0, National Institute of Standards and Technology, February 12, 2014.

The e-book was written to provide Critical Infrastructure customers and academic students an understanding of the NIST Cybersecurity Critical Infrastructure Framework and how to apply the framework to new and existing SCADA applications and implementations.

The objectives of this book are as follows:

1) Establish an overview and introduction of the EO13636 Improving Critical Infrastructure Cybersecurity.
2) Provide knowledge, understanding, and application of the five functions of the framework.
3) Apply tools and standards to enable the framework implementation.
4) Apply industry security recommendations to meet the framework categories.

Here are links to acquire the eBook:

Revision A-01.19.2015, Smashwords Edition: https://www.smashwords.com/books/view/510004
http://www.barnesandnoble.com/w/framework-for- scada-cybersecurity- richard-clark/1121119835?ean=2940046533521

BENEFITS

The eBook is free via the following links and can be used by faculty and students for cybersecurity courses covering the critical infrastructure and applying to content for Risk Assessments using the framework, understanding SCADA and control systems, threats, vulnerabilities, and how to mitigate risks using the Cybersecurity Critical Infrastructure Framework. There is curriculum for that uses this eBook available upon request. The eBook also covers the use of the Department of Homeland Security CSET tool and the InduSoft Web Studio Software that can be downloaded for free to allow students to create their own SCADA systems.

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TRANSFERABLE

Yes, this innovation is transferable to other institutions.

NICERC CONTENT PROVIDES K-12 TEACHERS WITH HANDS-ON TOOLS AND CONTENT TO INFUSE CYBERSECURITY AND STEM CONTENT INTO ANY PUBLIC-SCHOOL CLASSROOM

FACULTY DEVELOPMENT

DESCRIPTION

NICERC provides hands-on professional development, curricula, programs, and competitions to engage students in STEM disciplines. Project-driven curricula creates a context for the content at every level of learning. Professional development programs for K-12 teachers enable them to motivate creativity and innovation in students through problem-solving, critical thinking and communication.

NICERC works with its partners to design project-driven, application-based curricula that engages students across primary, secondary and post-secondary levels. Our curricula provides school systems with a rigorous program that showcases a systems-level understanding of real-world applications of science, technology, engineering, and mathematics. Our courses provide a hands-on, context-based approach to math and science professional development while incorporating liberal arts components, which allows teachers to embed the curricula across multiple disciplines and empowers them to prepare students to become the next generation of engineers and cyber professionals.

NICERC's professional development opportunities span across various cities nationwide. Teachers gain hands-on experience with projects and technology that provide new, innovative ways to engage students in the classroom. The professional development offered through NICERC provides a collaborative and comprehensive solution that fosters systemic and sustainable change in education. Through NICERC's teacher professional development model, more students are ultimately impacted (over a greater period of time) than would any program aimed at students alone.

BENEFITS

EDURange is easy to access and provides feedback to students and faculty, aiding in the assessment of student learning. By providing interactive, competitive exercises, it enhances the quality of instructional material while increasing active learning for students. EDURange has the following qualities:

- It's engaging. Students from various backgrounds can learn practical security concepts, tools and skills in puzzle-like scenarios involving realistic challenges.
- Scaffolding and assessment supports students in achieving learning objectives.
- It's easy for students and instructors to use. Scenarios run on VMs created in Amazon Cloud using scripts. Students don't need special software, EDURange can be used anywhere with Internet service. Instructors register their students, often grouping them into teams with accounts on the same VM, which facilitates collaboration. The EDURange system collects data to make assessment easier. Bash history visualizations allow quick determination of progress and whether additional guidance may be helpful.

CONTACT INFORMATION

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TRANSFERABLE

Yes, this innovation is transferable to othe institutions.

CYBER EDUCATION OUTSIDE THE CYBER SPACE

FACULTY DEVELOPMENT

DESCRIPTION

Cyber Education outside the Cyber Space involves immersing students (accidentally and/or intentionally) into an environment with limited or no access to the internet and developing a diction for understanding certain information security concepts.

BENEFITS

The benefits of the innovation is that it creates a common language between students and teachers to developing insights into cybersecurity concepts.

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TRANSFERABLE

Yes, this innovation is transferable to other institutions.

COMMUNITY COLLEGE COMPUTER SCIENCE AND TECHNOLOGY STUDENTS LEARN TO THINK WITH DAY OF CYBER

FACULTY DEVELOPMENT

DESCRIPTION

The Day of Cyber was incorporated into the Introduction to Computer Science, Software Design, and Python for Cybersecurity curriculum at Lord Fairfax Community College. Students in each section of these courses at the Middletown campus were required to complete the Day of Cyber. After the day, the content was incorporated during each of the weekly topics, such as secure programming, network security, internet safety, and career education requirements for computer science and software design (IT) students. The Day of Cyber challenges also were tied to the CTF-style cyber competitions and the cybersecurity students were required to create their own challenges based on what they learned from the challenges during the event.

BENEFITS

The benefit was that students were exposed to a third party (NSA) telling them about careers and skills needed professionally. This outside career exposure benefited students by letting them know what future employers will look for while validating what instructors are telling them. The benefit of introducing within computer science and IT courses is it gets these students to think about how cybersecurity is infused within their program of study and to see that it is not a stand-alone career topic. The benefit to the cybersecurity students is the Day of Cyber provided them a look at some jobs at the NSA and more importantly the types of entry-level challenges they may face on the job and at cyber competitions. The benefit to the cybersecurity program at LFCC is it increased interest in the cybersecurity club. This also created a group of students who could serve as support liaisons during a community Day of Cyber. This also encouraged me to acquire the Cyber Teacher certification and be part of the ACM two-year computer science committee that infused cybersecurity into the curriculum for community colleges. All or just part of this process could be easily adopted by other colleges.

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TRANSFERABLE

Yes, this innovation is transferable to other institutions.

CYBER SECURITY CLUB LED CYBERSECURITY AWARENESS SEMINARS

FACULTY DEVELOPMENT

DESCRIPTION

Morris County's Office of Information Technology manages security for 1,465 tablets, desktop and laptop computers used by county employees and understands the havoc that one careless click on a tainted web link can make. Our Cyber Security Club hosted and delivered seminars for County of Morris employees in partnership with chief information officer, John Tugman, and County College of Morris. The club demonstrated many ways an average citizen can protect their identity using different tools and tips such as Anti-Virus, Malware protection, stronger passwords, among others. We have created propriety presentations for these events to focus on the government aspect of cybersecurity.

Cyber Security Club hosts seminars every year on various days. Since 2014, the club in partnership with National Center for Excellence in Cyber Defense Education hosts events every week during National Cyber Security Awareness Month. The club shows many ways to protect devices and the importance of cybersecurity. During National Cyber Security Awareness Month, Club works with the Department of Information Technologies, Center for Cyber Security and County College of Morris to promote cybersecurity education and career paths. We have hosted capture the Ffag during the month as well, which has had pretty good turnout.

Data Privacy Day (DPD) is celebrated by County College of Morris every year in partnership with Cyber Security Club. During DPD, Club members and presentation teams show various types of passwords and how long it takes to decrypt them using tools like John The Ripper, test passwords using online tools and Web application security. The main audience during DPD is faculty and staff who are interested in incorporating cybersecurity in classes or learn for themselves.

BENEFITS

Cyber Security Club's main purpose is to promote cybersecurity education and career paths. However, over the years many other projects were developed such as Women in Cybersecurity, capture the flags and student learning aide. The biggest benefit of such events is training. Training is very important in any type of information security or cybersecurity. Along with training, students network and create connections with a variety of businesses and government agencies that can help them in their future career paths.

CONTACT INFORMATION

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TRANSFERABLE

Yes, this innovation is transferable to other institutions.

03

LAB ACTIVITY

WINNING SUBMISSION:
NETWORK DEFENDER - THREAT HUNTING HONORS PROJECT

NETWORK DEFENDER - THREAT HUNTING HONORS PROJECT

LAB ACTIVITY

DESCRIPTION

As part of a grant funded extension of the Grand Rapids Community College Center for Cyber Security Studies lab, we've created a live fire ethical hacking lab. This lab consists of a segmented network designed specifically for students to test ethical hacking methodologies and skills against virtual machines in a safe environment.

GRCC courses in Ethical Hacking and the student chapter of the GRCC ISC^2 use this network in order to test deliberately vulnerable virtual machines versus the techniques they are learning in class and in extracurricular study. While this lends itself to a focus on offensive security, it does not allow for student to deepen their knowledge of defense of security, perhaps the more difficult of the two.

The honors program at GRCC, part of the Department of experiential learning, allows for advanced students in the honors program to work on "Honors Projects". This innovationinvolved creating an honors project where students used threat hunting tools and methodologies to observe and document the attacks being carried out in both the ethical hacking classes and in the student chapter of the ISC squared. This involved the student creating and maintaining defensive virtual systems, such as Snort, Splunk, Bro sensor's, and NetMon freemium, and then to use these systems to discover, observe, and document the offensive activities going on in the lab.

BENEFITS

This innovation allowed advanced honors students studying information security to take a deep dive into one of the most exciting areas of information security practice. The experiential nature of the project, as well as the real-world application leveraged our existing infrastructure to create a new and interesting learning opportunities for students interested in taking their education to the next level.

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Yes, this innovation is transferable to other institutions.

A DESIGN FRAMEWORK FOR GENDER INCLUSIVE CYBERSECURITY COMPETITIONS BASED ON VIDEO GAME MODELS

LAB ACTIVITY

DESCRIPTION

Gender diversity is a recognized issue in the field of cybersecurity. Much research and effort have been invested in alternative means of addressing the gender disparity. One such alternative is cybersecurity competitions used in recruiting and educational modalities. Previous research revealed that competitors of both genders perceived these competitions to be designed in a non-gender inclusive manner. Thus, we analyzed existing literature to establish a gender inclusive design based on video game models. We coded the results into operational keywords and formed discrete taxonomic elements within an overarching cybersecurity competition design framework.

BENEFITS

This innovation has potential benefits for student competitors, educators and cyber competition designers. The framework affords the ability to design and implement cyber competitions to be gender inclusive across a variety of competition formats.

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Yes, this innovation is transferable to other institutions.

BUILDING A VIRTUAL ENTERPRISE NETWORK ENVIRONMENT FOR APT EXPERIMENTATION

LAB ACTIVITY

DESCRIPTION

Advanced Persistent Threat (APT) represents a class of the most sophisticated, targeted, stealthy, and potentially devastating cyber attacks. Detecting these threats has proven to be very difficult due to the potency of these attacks and the general lack of defensive capabilities by the victims. Cyber defenders will need not only better tactics, techniques and procedures, but also a workforce better trained in preventing, defending against, detecting, responding to, and mitigating the effects of APTs. Given the nature of the APTs, training cyber defenders will not be an easy task. An effective learning environment must be provided for the learners to gain hands-on knowledge, skills, and experience.

A first-iteration virtual lab environment for enterprise APT learning and experimentation has been designed and implemented. This environment is designed to operate on XenServer virtualized infrastructure and composed of a number of building blocks (e.g., router/firewall, Microsoft Domain Controller, web and email servers, Kali Linux).

The Gh0st malware is chosen as a case study of the APTs, as it has been widely employed worldwide to take full control remotely of vulnerable Windows platforms. A simulated Gh0st attack scenario is implemented using the virtual lab environment to illustrate the lifecycle of a cyber kill chain.

BENEFITS

This virtual lab environment for enterprise APT learning and experimentation is designed to support experiential, self-directed and continuous learning. It provides a safe and convenient environment to gain hands-on knowledge. Designing and implementing such an environment is an especially rewarding experience for students. The environment is designed to run on large-scale virtualized or cloud infrastructures which could be used to support communities of learners. It is also designed to be extensible such that additional components and capabilities can be integrated into the implementation in an incremental and iterative manner.

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Yes, this innovation is transferable to other institutions.

INCIDENT RESPONSE DRILLS - TEAM A VERSUS TEAM B USING REAL-WORLD SCENARIOS

LAB ACTIVITY

DESCRIPTION

Using real-world scenarios (drawn from my years of being an information security practitioner for large enterprises), the class is divided into two groups (team A versus team B) and given limited information about a suspected compromise. A designated 'CISO' for each team then leads the rest of his or her team in formulating a response on the suspected compromise, including:

- what further information should be collected and from whom (e.g., position and/or business unit)
- how to handle the press as well as superiors
- what actions should occur in what order/sequence

At the end of the 45-minute time limit, the CISO (and others as appropriate) are required to brief the CIO (CISO's manager) and the other team about the issue (e.g., what is known, what is not known), what further information is needed, why, and source, as well as recommended actions. The point is to bring together all vulnerability and exploit information learned to date as well as other aspects of information security. These exercises quickly bring home to the students "the fog of war [attacks]" and the need to quickly develop a systematic approach to information gathering and response.

BENEFITS

This isn't really novel, but it's an important exercise and, most importantly, the students love it! The exercise really brings home the value of their learning and training. Think of this as CTF meets the enterprise, and for most of our students (who lack information security in a large enterprise) it is a real eye opener.

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A WINDOWS-BASED GH0ST MALWARE VIRTUAL LAB ENVIRONMENT

LAB ACTIVITY

DESCRIPTION

Gh0st malware is a very good example of Advanced Persistent Threat (APT) which represents the most sophisticated, targeted, stealthy, and potentially devastating cyber attacks. It is a Remote Access Trojan (RAT) used to take control remotely of vulnerable Windows platforms from a RAT command and control host.

A desktop virtual lab environment, using VMware hypervisor running on Windows, has been developed to illustrate the cyber kill chain of a simulated Gh0st attack, using phishing email against a targeted victim. It is implemented with three VMs: an Attacker (Gh0st command and control), a Victim (Gh0st compromised host), and a FTP Server (for downloading the Gh0stmalicious payload to the victim's machine). A real-life Gh0st RAT executable is used on the Attacker VM.

The Gh0st virtual lab environment can run on desktop or laptop computers with modest computing resources. Step-by-step instructions are provided for users to create this virtual lab environment on their own computers, and then they execute the simulated attack to see Gh0st in action.

BENEFITS

The Gh0st virtual lab is designed to support experiential and self-directed learning. It provides a safe and convenient environment for users to gain hands-on knowledge, skills, and experiences in APT/Gh0st which are among the most complex and difficult malware to learn. The virtual lab can be created and deployed on many desktop or laptop computers running a Windows operating system. Creating one's own environment and executing the simulated attack requires a modest level of computer science or IT knowledge and skills typically expected of students at two-or four-year college programs. Creating this environment and going through the lifecycle of the simulated Gh0st kill chain (from the Weaponization to the Actions on Objectives phases) provide opportunities for users to gain more in-depth and holistic understanding of the sophisticated APT/Gh0st.

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PLUMBUS HACK ENGAGING STUDENTS THROUGH POP CULTURE

LAB ACTIVITY

DESCRIPTION

Students are given a fake scenario that is based off of a popular tv show called "Rick and Morty." Here is the scenario:
Ticket 029 (For this exercise you will use the Hacked Skytap Environment)

Kail 10.0.0.3 username: root password: toor

Win10 10.0.0.2 username: administrator password: Password10 (Nexpose username:admin password: Nexpose#1)

WSFS 10.0.0.1

*So I am the only one that knows the password to WSFS. I have a file in the C:\topsecret folder that is the design of the plumbus.

Another company has our same exact design and I found the file on the internet. This means we got hacked.
I want you to perform a penetration test and see if a common script kiddie could download the file on WSFS.
I have nexpose installed on Win10 and have given you access to Kail. I want you to run a vulnerability scan against WSFS. Then identify a vulnerability that would allow you to execute a metasploit meterpreter shell and download the file contained in the C:\topsecret folder.*
The file happens to be a 3d printer image of a "plumbus"

If the students are able to get the file, they are presented with a 3D printed "plumbus."

BENEFITS

I believe that this engages students in a number of ways:
1. It ties the lesson/activity to something they can relate to.
2. It's a challenge where they are taking things they have learned and applying them to an scenario.
3. There's a prize (that has no cash value), but it really becomes a bragging right and allows them to put a face value (other than a grade) to the lessons they have learned.

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ITSC-1316 LINUX INSTALLATION AND CONFIGURATION "DEPLOY A LINUX WEB SERVER USING AMAZON WEB SERVICES!"

LAB ACTIVITY

DESCRIPTION

During our course progression we teach Linux and Linux administration to students. The goal is to get them prepared for the CompTIA Linux+ 103+104 which gets them into a possible SUSE Certified Linux Administrator certification allowing them to transfer to the workforce with a leg up over their competition.

Because we're seeing an increase in both virtualization and Cloud services, I have designed the course to be taught both as a hardware and virtualization course with a focus on VM Workstation 12, ESXi 6.0 and VM VSphere to maximize the impact and potential of this crucial OS to the students. They take very well to both virtualization and Cloud services. Students are able to make their own Apache Web-server, Wordpress blog/website and more if they choose. Aside from being fun, these labs/assignments are great practice for real world applications. Here at Texas State Technical College at Fort Bend, we help educate Texans for high-paying jobs.

BENEFITS

Aside from Linux being one of the most mandatory skills in the workforce, it's also one of the most sought after skills. Educating Texans for high-paying positions in the workforce is what TSTC does. When our students prepare for the Linux+ CompTIA exam, they are investing in their future as well as their wallets. Making a huge impact on their career by learning Linux, virtualization, AWS and Cloud services helps them move up in life as well as furthering their careers.

CONTACT INFORMATION

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COLLABORATIVE EFFORTS BRINGING CRIMINAL JUSTICE AND CYBERSECURITY TOGETHER THROUGH COMPUTER FORENSICS

LAB ACTIVITY

DESCRIPTION

I designed the curriculum as an introduction to computer forensics with no prerequisites so our criminal justice students could take the course as an elective. Computer forensics is an important area in the public sector (law enforcement) making for a collaborative course between cybersecurity and criminal justice students. Our criminal justice students know more of the legal aspects while our cybersecurity students know more of the technical aspects to make an interesting diverse group of students.

I have various staged crime scenes where the students gather the physical digital evidence such as hard drives and flash drives to bring into the lab. The lab has three Forensics Recovery Evidence Device (FRED) units where students team up to gather forensically sound images of the physical evidence gathered from a staged crime scene. FRED units are used by law enforcement and government agencies to give students some realistic hands-on approaches with actual equipment to do a computer forensics investigation.

BENEFITS

Combining the two groups of students with real equipment creates an environment to spread cybersecurity awareness to a broader range than just our cyber/IT students. The course also is open for other majors to take as an elective. The focus was the criminal justice students, but I have computer science and other majors who take the course as well. The course is by far my favorite to teach and brings in so many different levels of experiences and viewpoints making for a fun course. My first group of students still talk about how much fun they had, made lasting friendships and some even changed their career choices.

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Yes, this innovation is transferable to other institutions.

04

LOCAL PARTNERSHIP

WINNING SUBMISSION:
PROVIDING STUDENTS HANDS-ON EXPERIENCE AND VOLUNTEERISM THROUGH WORK WITH NONPROFITS

PROVIDING STUDENTS HANDS-ON EXPERIENCE AND VOLUNTEERISM THROUGH WORK WITH NONPROFITS

LOCAL PARTNERSHIP

DESCRIPTION

Most Cybersecurity and IT positions require experience, but to gain experience one must have the IT or cybersecurity job. This poses a frustrating problem for students who wish to enter the IT and cybersecurity disciplines. Working with over 40 nonprofits and cross-class and cross-school teams, pairing undergraduate and graduate students and online and on-ground students over 80 community service projects have been completed. Students are empowered to solve problems, troubleshoot, research, consult other students, and complete projects incorporating diverse teams made up of undergraduate, graduate, on-ground, online, and cross-school teams.

As a teacher it can be difficult to "script" activities that are realistic, unique, and timely given the limits of time, budget, and equipment. This option solves the problem with only a negligible impact on resources. It benefits faculty as they stay current working on real-world problems and with different equipment and settings.

Not all students work directly with the nonprofit, the equipment, or the facility. Some are remote and offer consultation services that teams "purchase" with predetermined credit so that the remote students are not overwhelmed or the option abused. Every student who participated has had only positive feedback and many offer future assistance after completing the course because of the experience gained.

BENEFITS

By partnering with nonprofits students can gain necessary experience, increase volunteerism and community enhancement entries on their resumes, improve self-efficacy, and improve soft skills including communication, problem solving, project management, and research. Students learn to communicate with different populations and identify solutions to customer needs. The community is improved as nonprofits benefit from free or low cost (if equipment must be purchased) solutions to problems that allow for continuation or improvement of their service efforts. Faculty stay current by working on real-world, unscripted and unpredictable problems in IT and cybersecurity.

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LOCAL COMMUNITY CYBERSECURITY COLLABORATION

LOCAL PARTNERSHIP

DESCRIPTION

Through a partnership with the Allegany County Public School System and Allegany College of Maryland, high school students will start to prepare for cybersecurity careers in the ninth grade. Made possible through Pathways in Technology Early College High School (P-Tech), students in Allegany County, Maryland, will be working toward their associate degrees starting in ninth grade. They will have the option to complete in four, five or six years through a partnership with Allegany College of Maryland's cybersecurity program. Local employers and the Western Maryland IT Center for Excellence have committed to internships and opportunities at program completion. Frostburg State University is also a strong partner, providing further educational opportunities to these students wishing to continue to pursue their bachelor's degree.

BENEFITS

The benefits include a strong collaboration and sense of community, bringing the major educational institutions together in rural western Maryland. This partnership provides future economic growth and opportunities for expansion. Having a highly skilled and trained workforce will incentivize and attract more cybersecurity companies to startup or move to western Maryland. Most importantly, this collaboration provides the necessary training and education required to address the severe cybersecurity workforce shortage.

CONTACT INFORMATION

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Yes, this innovation is transferable to other institutions.

THE "FLIPPED DEGREE" - A CAE-2Y TO CAE SCHOLARSHIP FOR SERVICE PARTNERSHIP!

LOCAL PARTNERSHIP

DESCRIPTION

Anne Arundel Community College (AACC) and George Washington (GW) University partnered to create one of the first CAE-2Y to CAE Scholarship for Service Partnerships. Two students will complete their associate degree in Information Assurance and Cybersecurity at Anne Arundel Community College and transfer into The George Washington University's program for a bachelor's degree in Computer Science. In a traditional transfer program, students complete years one and two of their degree at a community college and final two years at a four-year university. In this program, students have completed the last two years at the community college and will enter their university to complete the first two years. This innovative approach can best be describe as a "flipped degree."

A traditional four-year computer science student at GW would complete their required computer science courses in years one and two and then complete their elective (or specialty track) courses in years three and four. In this innovative partnership, two students have completed the requirements of years three and four of GW's bachelor's degree in Computer Science in years one and two at the community college. In essence, rather than their specialty track being complete as a junior and senior at GW, it was complete at the community college in their freshman and sophomore year.

In the fall, these two students will transfer from AACC to GW to complete the requirements of their bachelor's degree.

In May 2019, the students will graduate with a BA in Computer Science from GW with a specialty in cybersecurity. It will be the perfect pairing of the technical skills of an associate degree in cybersecurity with the rigor of a bachelor's degree in computer science.

BENEFITS

The benefits of this innovation include the following:

- An innovative way to solve the nation's cybersecurity workforce shortage by tapping into the talent of community college students
- Introduces a new way of linking an AAS degree and a BA/BS degree, aka the "flipped degree"
- Illustrates the ability to transfer a community college "cyber" degree into a four-year university "computer science" degree
- Illustrates the ability of community college students to handle the rigor of a nationally ranked four-year institution's program. We hope that this program, through the success of these students, will break down the stereotype associated with being a community college student.
- Allows the future workforce to have the benefit of the computer science degree while also having the technical hands-on

CONTACT INFORMATION

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TRANSFERABLE

Yes, this innovation is transferable to other institutions.

REACH OUT TO THEM EARLY!

LOCAL PARTNERSHIP

DESCRIPTION

Cybersecurity faculty have gone to Frederick County Middle School and talked about cybersecurity with eighth graders in the Career Cafe sessions. They participated in the World of Works in Winchester, Virginia, at a table to introduce cybersecurity to 3,000 seventh graders in 1.5 days. This setup included real-time virus maps, an Engima machine and cybersecurity games. Students rotated at the table throughout that time, ensuring a diverse group was present, including women and non-traditional students.

We partnered with the local high schools to bring their Cyber Camp (Winchester Public Schools and Luray/Page County Schools) participants to Lord Fairfax Community College (LFCC) for a day to complete the Day of Cyber to practice cryptography, forensics and much more. This gave them hands-on team experience and allowed them to start building a relationship with college faculty by asking questions about their prior work experience.

Dr. Henry Coffman also serves as advisor for building a cybersecurity program at the Winchester Public Schools new Technology Center and was requested to speak on May 22 at Sherando High School. Dr. Coffman is innovative by serving on Virginia's Cyber Range executive board and taking novice cybersecurity students to cyber competitions to learn and improve. For example, he wanted to take his students to the first VA Cyber Fusion competition at VMI, but they were not ready to complete. He did not want them to just do a job interview and convinced the CyberFusion planning committee to add a "mock competition" for teams who were still learning. Dr. Coffman has partnered with the local newspaper and TV station to promote cybersecurity as a profession. He created an AAS program in cybersecurity instead of having it as a subset of the AAS in IT. Dr. Coffman was at the second community college in Virginia to became a CAE. Dr. Coffman also was the first in the Virginia Community College System to offer a programming course designed specifically for cybersecurity in which students learned programming through ciphers, packet sniffers, backdoors, and other security-related topics.

BENEFITS

The benefits are cybersecurity college students are in the community talking about cybersecurity and graduating from a CAE school. The high school students benefit by learning more about the profession before graduation and building relationships with college faculty. Middle school students are being exposed to the profession early while the state of Virginia requires them to create a career pathway. The benefit to the college from Dr. Coffman's activity in cybersecurity organizations like VA Cyber Range and National CyberWatch is staying current on cybersecurity happenings and keeping top notch curriculum. All of these things are transferable to other institutions if the institution has employees willing to donate the time and effort into planning these activities.

CONTACT INFORMATION

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Yes, this innovation is transferable to other institutions.

STUDENT INITIATIVE

LOCAL PARTNERSHIP

DESCRIPTION

The ISSA- Chicago Chapter started a Student Initiative with local community colleges and universities to participate with the ISSA and allied security organizations in the Chicago area. Enrolled college students can attend our events at a discounted rate (many of the events are free to students).

BENEFITS

Bringing college students together with security and technology professionals to learn about the industry and job opportunities.

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TRANSFERABLE

Yes, this innovation is transferable to other institutions.

WEEKLY SIGNATURE SEMINAR ON CYBERSECURITY AND GOVERNANCE

LOCAL PARTNERSHIP

DESCRIPTION

The George Washington University (GW) requires all CyberCorps cybersecurity scholarship students to complete a distinctive weekly course that brings cybersecurity students from all disciplines from juniors to doctoral students to give them a thorough understanding of government roles and activities in cybersecurity. It provides students with up-to-date practical insights into technical, privacy, cost, risk, and user acceptance elements of fielded and proposed systems.

Each week, the instructor assigns students to study the vulnerabilities and mitigation strategies related to a recent cyberattack. The students research the attack and then present their observations about both the causes, mitigation strategies and lessons learned as they apply to government policy and general cybersecurity practices. These student presentations build esprit de corps and public speaking skills.

A regular feature of the seminar is a visit of a speaker from a government leadership position or an industry expert who reinforces concepts, shares insights, and meets informally with scholarship students. Often these include leaders in developing the policies. Past speakers include: Gen. Michael Hayden (Ret.), former director of the CIA and the NSA; Kevin Mandia, CEO, Mandiant; Vint Cerf, vice president and chief internet evangelist, Google; Ron Ross, Fellow, National Institute of Standards and Technology; Phyllis Schneck, deputy undersecretary for Cybersecurity and Communications for the National Protection and Programs Directorate (NPPD) , Department of Homeland Security; Chris Painter, director of Cybersecurity for the White House National Security Council; and Congressman James Langevin, co-chair of the Congressional Cybersecurity Caucus.

BENEFITS

Students engage in the entire security certification and accreditation, audit and system security plan processes. The course readies students to contribute to a government cybersecurity environment on their first day in the federal workforce. It also provides students valuable informal networking and contacts, many of which have led to internships and jobs. The course is transferrable to other institutions in a state capital or other locations with a number of government and industry experts with practical experience.

CONTACT INFORMATION

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CLASSROOM CONVERSION TO A MINI-DATA CENTER/CYBER SECURITY SANDBOX

LOCAL PARTNERSHIP

DESCRIPTION

Two years from planning to fruition. As a result of the generosity from a business partner, we were able to convert a regular classroom into a mini-data center with 16 servers running VMWare ESXi 6.0. This configured environment also will serve as a cybersecurity sandbox with nine pods of Cisco routers, switches and adaptive security devices.

We have a number of cable management ladders and routers racks containing network equipment and devices physically placed throughout the classroom representing a dispersed environment throughout the world. For example, each center is named after, New York, Tokyo, London, Paris, and Sydney.

BENEFITS

The mini-data center replicates a real world environment where all servers can be monitored from a central location all within the classroom. Another benefit is understanding and applying RAID in a data center environment. The cyber security sandbox will allow students to develop their skills relative to cybersecurity without fear of compromising the FUSD network infrastructure. We believe that we here at Irvington High School in conjunction with Mission Valley ROP have the only setup of this kind at the high school and most likely college level in the state.

CONTACT INFORMATION

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Yes, this innovation is transferable to other institutions.

SEEKING ASSISTANCE WITH TAKING THE CISSP EXAM AND TEST PREP MATERIALS

LOCAL PARTNERSHIP

DESCRIPTION

I am the Division Information Systems Security Officer (ISSO) for a company contracting with a federal agency. I have a strong background in IT and Network Engineering. I have transitioned into the cybersecurity and Cloud security fields consulting with federal government and private companies in the areas of cybersecurity, Cloud security, information assurance, compliance and risk management. I am an educator and technical trainer in these fields, also.

To further my career, I am required to get my CISSP Certification. I am seeking assistance with the CISSP Exam and Test Prep Materials to further the role of women in technology and innovation to teach girls that they can excel in technology!

BENEFITS

The benefits of the innovation include increasing my cybersecurity education, advancing to a higher career level, building my resume, applying for tenure-track at a university, being a role model to girls, women and those in underserved communities, while giving me leverage to break through to success.

Submissions will be published and promoted through a National CyberWatch Center publication, in monthly newsletters and social media campaign.

All educators in cybersecurity are encouraged to submit. Please share with your colleagues, and spread innovation all around! I have a strong background in IT and Network Engineering. I have transitioned into the cybersecurity and Cloud security fields consulting with federal government and private companies in the areas of cybersecurity, Cloud security, information assurance, compliance and risk management.

To further my career, I am required to get my CISSP Certification. I am seeking assistance with the CISSP Exam and Test Prep Materials to further the role of women in technology and innovation to teach girls that you can excel in technology!

CONTACT INFORMATION

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TRANSFERABLE

Yes, this innovation is transferable to other institutions.

A HIGH SCHOOL SOPHOMORE AND CA CERTIFIED CYBER TEACHER LEADS HER PEERS IN THE DAY OF CYBER

LOCAL PARTNERSHIP

DESCRIPTION

A dual-enrolled student, Rachel, who is a sophomore at Sherando High School in Stephens City, Virginia, completed the Day of Cyber under Dr. Henry Coffman who leads the cybersecurity program at Lord Fairfax Community College while she was just a high school freshman. She enjoyed the program so much she signed up as a teacher with the Day of Cyber in hopes of sharing what she learned with her fellow Girl Scouts. She took advantage of the "free" certification offered to teachers through the Day of Cyber. The Governor of Virginia offered a cyber challenge to Virginia Schools to host as many students via the Day of Cyber as possible. Though it took a while, Rachel was able to finally host a Day of Cyber this spring at Sherando High School for her peers at the schools after school Technology Club. All attendees were able to earn their Day of Cyber certificates with Rachel providing hints and instructions throughout the two-hour event. Even though this event did not count in the Governor's Cyber Challenge Now, the Technology Club is set to host bigger and more "Day of Cyber" events at their high school for the 2017-18 school year.

The clubs K-12 teacher sponsors did not know about the Day of Cyber or understand how it could be incorporated into the business/IT curriculum. Rachel spent time with her teacher, Mrs. Susan Ritter, explaining the teacher sign-up process, how to host a Day of Cyber and provided suggestions on how it could be used in the classroom in the CIS 1 and CIS 2 classes at the high school. This also helped spark a small team of boys to compete in a high school CTF competition hosted by Radford University in April. While the team placed in the bottom of the rankings, they were inspired to learn more about cybersecurity.

BENEFITS

The benefits of this innovation is that a dual-enrolled, high school student bridged the gap between Lord Fairfax Community College and her high school through the Day of Cyber. She promoted career awareness in computer science and cybersecurity at the NSA by having them work through all seven journeys to see the education and skill requirements. Now the entire technology team can serve as support for future Day of Cyber events at the high school and in the community. She was able to enhance the CIS curriculum at her high school by getting it added by the Technology Club teacher into her course. She promoted faculty development by teaching the K-12 teacher about cybersecurity, demonstrating how to lead a Day of Cyber, and suggesting the K-12 teacher get Cyber Teacher credentials. It also showed faculty members at the college that they need to be in the high schools working with the students, instead of waiting until they graduate. The local partnership between the high school and college was strengthen and may increase the enrollment into the college cybersecurity program. It truly showed the impact of what is taught in the college classes that allow dual-enrolled students to see what they can have in the future. This would be easy to duplicate by other institutions via a summer hosted Day of Cyber for K-12 leaders or high school students or by adding a Day of Cyber into all introductory technology college courses.

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TRANSFERABLE

Yes, this innovation is transferable to other institutions.

RAISING CYBER AWARENESS

LOCAL PARTNERSHIP

DESCRIPTION

We are in an unprecedented change of information technology so we are interconnected with the cyber world. We exchange our most important information throughout cyber space, so it is really important to maintain our resources securely in any possible way. We want to make people aware of how important is it and its potential, As a responsible citizen, it's our duty to protect our information and resources.

BENEFITS

- How we can be benefited by rebuilding a strong cybersecurity infrastructure? What can we innovate?
- Is there anything that would bring an enormous difference?
- What kind of expertise do we need to build a strong cybersecurity shield?
- How can we open up our inner possibility to discover something more secure?

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COMPUTER CLUB CYBER DAY

LOCAL PARTNERSHIP

DESCRIPTION

Once per semester, on a Saturday, our club invites students, faculty, staff, and members of the public to bring in their computers, smartphones and tablets for a tune-up and virus and malware scan and removal. The students service the devices and install free virus and malware protection on them. During this time, the students educate the users on basic security and stay safe online principles.

BENEFITS

It is said that to teach is to learn twice. Our students benefit by teaching others about cybersecurity thus reinforcing what they have learned. Members of the public benefit from safer systems and greater security awareness. Our program and college benefits from the positive feedback and media exposure the event generates.

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MERIT-BASED ACADEMIC SCHOLARSHIP OPPORTUNITY TO QUALIFIED COMMUNITY COLLEGE STUDENTS TO COMPLETE A CYBERSECURITY PROGRAM AT A PRESTIGIOUS UNIVERSITY

LOCAL PARTNERSHIP

DESCRIPTION

In partnership with George Washington University (GWU), two students majoring in cybersecurity at Prince George's Community College (PGCC) were selected to receive CyberCorps scholarship to complete their bachelor's degree in cybersecurity at GWU. The full academic scholarships are merit-based and awarded by the National Science Foundation (NSF) to students who meet certain academic standards. The selected students will receive scholarship funds to cover stipend, tuition, fees, books, and professional development activities for their second year of study at PGCC and their final two years of study at GWU.

BENEFITS

Using the scholarship, the students will not have any need to work, and they can devote their time to complete their studies in the given timeframe. As they go through the program, they will engage in professional development activities. These include attending conferences as well as attending the annual NSF-sponsored cybersecurity job fairs to get summer internships and job placement in cybersecurity with a government agency at a federal, state, local, or tribal level.

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No, this innovation is not transferable to other institutions.

05

STUDENT LEARNING AID

WINNING SUBMISSION:
CAREFULLY COMBINING STRATEGIES HAS A BIG IMPACT ON CYBERSECURITY EDUCATION FOR THE YOUNGEST LEARNERS

CAREFULLY COMBINING STRATEGIES HAS A BIG IMPACT ON CYBERSECURITY EDUCATION FOR THE YOUNGEST LEARNERS

STUDENT LEARNING AID

DESCRIPTION

As an elementary CS teacher working with students from preK to grade 5, helping young learners master the basics of cybersecurity is an essential part of my work. They represent the group at the very beginning of the workforce pipeline, so getting them excited about cybersecurity is an important goal. Students benefit from a variety of different types of exposure to the material. In the early grades, the right combination of experiences is what really enhances the learning.

Class discussion and learning from peers helps keeps students socially connected to technical concepts. Animated videos from providers such as BrainPopJr and Education City provide multimedia content and comprehension checks. Excellent free teaching materials on basic cybersecurity concepts are also available from the CyberPatriot National Youth CyberEducation Program. My youngest students loved playing the "Security Showdown" game. First grade students already knew some basic coding from working with the free mobile app, ScratchJr. (developed by MIT). For a culminating project, they made their own animated stories modeling one of the cybersecurity concepts we addressed: personal information, staying safe online, system protection, etc.

Incorporating social learning, multimedia, gaming, creative programming, project-based learning, and knowledge-sharing is an approach that works. Ending with a project demonstrating core cybersecurity concepts allowed students to make creative choices and engage deeply with the content. They were so proud to share what they learned and accomplished, and the entire class saw how each project had a different but valuable perspective, further enriching their learning experience.

BENEFITS

Cybersecurity knowledge is not only important to the personal and career development of young learners, but also for our entire society. I play a part in making sure future generations are ready to help meet the needs for cyber defense. Sometimes the most innovative approach is using the best practices in education to select the right materials and apply them in just the right combination. Teachers can and do make this happen every day!

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STUDENT LED RISK MANAGEMENT CLASSES

STUDENT LEARNING AID

DESCRIPTION

For an in-class face-to-face graduate level cybersecurity risk management and compliance course that I designed, we have to cover cybersecurity risk management and compliance from a business perspective. We have to cover risk frameworks such as NIST 800-53v4, SP800-37, SP 800-39, and NIST Risk Management Framework. Given the amount of material as well as the dryness of the material, when I was first assigned to teach this class, I decided to experiment and break up all the required reading into 25 equal parts (the typical class size). Then I had each student research an assigned piece, bring in humor and anecdotes they could find, develop games to engage the class, create interesting slides, and lead the class discussion for a 30-minute segment as a graded assignment. This would not only give them experience in presenting the material in an interesting way, it would also let everyone, including me, enjoy the material in a new way every semester.

I provided the first couple of introductory lectures to set the context and then had four students present in each subsequent class. Students were amazingly creative. Some students presented and then played Cybersecurity Jeopardy, Cybersecurity Millionaire, and various other games. They brought in candy or treats and gave them away as their fellow students provided correct answers to questions. I helped with appropriate additions to the material as needed and coached the students on their presentation skills.

Based on the student surveys and feedback, the results surpassed my expectations. Students had a lot of fun with the dry material. They learned from each other a wide range of presentation skills. They learned how to insert appropriate humorous content into the art of teaching cybersecurity. They learned how to engage an audience. Best of all, they demonstrated that they could really apply the material to real-world situations. The whole experience was so positive for me that I now use this method to teach this class, and it has never been boring for me or my students. Several students got jobs and internships before graduation when they shared the work they had done in this class.

BENEFITS

The learning that students achieved was amazing. Some students picked a topic area they were really interested in focusing on. This allowed them to research that aspect deeper, and the whole class benefited from that experience. The class actually was richer than it would have been if I had been the sole lecturer for the entire term.

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CYBERSEC TRAINING BEYOND BORDERS FOR THE FUTURE WORKFORCE GENERATION (K-12 STUDENTS)

STUDENT LEARNING AID

DESCRIPTION

This project-based learning program encourages students from all ages to be creative by imagining, inventing, implementing, and improving any type of ideas. They achieve this while collaborating with each other.
Learning must go beyond hard skills and formal qualifications. Cognitive flexibility, critical thinking, active listening, design, and logical/spatial creativity are needed to promote self-evolution.

Our IoT Camp and Cyber Defense program was created to address the international shortage of cybersecurity experts and to build the next generation of skilled workforce in all aspects of networking, infrastructure, Cloud computing, virtualization, servers, and mobile device management end-to-end operations who will be recognized in the industry among an elite group of security professionals.

BENEFITS

The students will be able to understand how to use technology to improve and mature business processes following the UX user experience and to be adaptive to any technological change or business model trend. Our approach provides the necessary tools to create a lifelong learning need and self-reinvention without sacrificing business performance and social impact. Children learn how to question authority and how to understand the legality behind their acts in life. This will create the ageless worker generation.

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CHALLENGING THE COMPUTER SECURITY CLASS TO EXPLOIT THE NETWORK CREATED BY THE INFRASTRUCTURE CLASS

STUDENT LEARNING AID

DESCRIPTION

In the Spring of 2007 I was teaching two courses: Computer Security and Network Infrastructure. As I learned about intramural competitions in the Computer Security Field, I decided to end both classes with an intramural competition between the two classes.

A network was to be created by an Infrastructure class that was accessible by at least one administrator account and user accounts for each member of each class. I provided a file (McGuffin.pdf) which the Infrastructure class was supposed to protect.

The Computer Security class members were given log-in information so they could access the network They were provided with the McGuffin name but not type of file. The CS class was expected to export the file and/or print out the file. The NI class was expected to protect the file from the expected attack.

BENEFITS

Peer competition as a team builds knowledge and cooperative experience. Pitting one student class against another generates engagement in the subjects being taught and the practical nature of what the students are studying. Students also appreciated the practical application of of the vocational education being offered by the Computer Network Administration Program.

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BUSINESS READINESS IMMERSION

STUDENT LEARNING AID

DESCRIPTION

Task-based learning (NICE Cybersecurity Workforce Framework) using a ticketing system (osTicket) to manage the workload. The ticket contains a help request (scenario) with additional attached internal notes supplementing the scenario (from the ECLASS model) with Exploration-how to find the information needed to solve the issue; Clarify- qualified / specific information about the issue or solution; Look- a demonstration of the solution; Act- links to the virtual machine with the issues to be fixed (VMs are provisioned for the student with the ticket is opened); Summarize- write up the follow-up paperwork, report to customer, how-to for the knowledge base, etc; Self-evaluate- compare your work with example work and apply the provided rubric to determine the quality of work you, the student, are doing.

The ticketing system is complemented with a self-provisioning vmware vsphere which clones lab templates for each student, provides them a reset button to reset the machines to their original deployment (if they get totally lost along the way), and console access to the systems in the task. This is all provided without the students having to have any vmware experience (web-based scripts and pop-op console windows).

The last feature (yet to be completed) is to implement a monitoring system which could report when the student had successfully fixed the issue on the virtual machines.

BENEFITS

The continuous story line of the scenarios keeps student involved. The ticketing system gives the student a real-world experience. The ECLASS model emphasizes 21st century skills—online research, critical thinking, guided self learning, business writing, and self-evaluation of work. It transfers instructor time from grading labs and reports to reviewing the students self-evaluations and providing more individual assistance.

CONTACT INFORMATION

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Yes, this innovation is transferable to other institutions.

CYBER VIRTUAL LEARNING ENVIRONMENT (VLE) IMPLEMENTATION

STUDENT LEARNING AID

DESCRIPTION

The University of Arizona designed, constructed and implemented a dedicated Cyber Virtual Learning Environment (VLE) in order to deliver our cyber operations courses to students in a consistent manner across all three learning modalities: Face-to-Face, Hybrid, and Fully Online. Our VLE is built upon a hybrid architecture with both Cloud and physical resources. We have full packet capture capability in every area of our VLE to support both learning analytics and future research opportunities. Our VLE consists of the following components: Student Portal, Faculty Portal, Network Operations Center, Live Attack Map, CyberApolis,Forensics Lab, Malware Sandbox, Capture the Flag Arena, Internet of Things (IoT) Lab, and Honeynet Lab.

The Student Portal provides our students with the ability to log into both Windows and Linux desktops within our Cloud infrastructure. By delivering student desktops through this infrastructure, we negate the need for students, instructors or the university to invest in high-performance computer systems. These desktops are preloaded with fully-tested software baselines that each student accesses, providing a consistent learning experience between students regardless of the student's computer system or learning modality. Our student portal is implemented through a VPN connection with multi-factor authentication to ensure security. The Faculty Portal provides for a single point of entry into our VLE, regardless of whether the faculty is on campus or utilizing our remote access capability and provides a mechanism for faculty to automatically register students as well as provide access to the course's environment and data. Faculty can launch and record learning sessions to allow for both synchronous and asynchronous course delivery, and monitor the status of each student individually.

CyberApolis is the University of Arizona's virtual city, inhabited by 15,000 highly-detailed virtual personas, each with over 60 data points, including data such as their full names, addresses, social security numbers, credit cards, login credentials for social media, banking, retail, and medical accounts. Virtual persona activities and social media postings are managed by human interaction to support specific learning objectives or through our advanced artificial intelligence algorithms that create thousands of virtual persona interactions everyday. CyberApolis also has a robust web presence to support cyber-related activities. Each website has a full network presence with built-in security vulnerabilities designed to support specific learning objectives.

BENEFITS

Our VLE allows us to offer quality cyber education to our students through multiple modalities and provides them with hands-on cyber education and training that replicates real offensive and defensive cyber capabilities in a controlled environment. The VLE was designed and built to achieve specific learning objectives, with all activities and assessments engineered to support those objectives.

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TRANSFERABLE

Yes, this innovation is transferable to other institutions.

CREATE AND CONTAIN

STUDENT LEARNING AID

DESCRIPTION

It may not be an innovation, but it is something, even if irrelevant.
The central intention would be that in creating an innovation or something related, the student would be legally bound by norms and laws—what can or cannot that done.

PS: Forgiveness of fast writing. I created this right now.

PS 2:. Phone number: 55 21 9 7699 2425

BENEFITS

Teaching legislative education. That legality exists and that depends on creation, but there are limits.

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No, this innovation is not transferable to other institutions.

EDURANGE, A FRAMEWORK FOR HANDS-ON CYBERSECURITY EXERCISES THAT ARE EASY TO ACCESS AND PROVIDE FEEDBACK TO STUDENTS AND FACULTY

STUDENT LEARNING AID

DESCRIPTION

We set out to create a platform for teaching security analysis skills to undergraduate students. We wanted exercises that weren't too prescriptive but still provided enough guidance for students to succeed without a comprehensive, encyclopedic knowledge of computer science and cybersecurity. We surveyed the landscape of hands-on activities in cybersecurity education and discovered cookbook-like exercises and open-ended competitions with little in between.

There also were technical issues. Some frameworks required virtual machines (VMs) to be installed on student laptops or our lab computers, which often led to installation and configuration headaches and made it difficult to support collaborative activities. Private cloud-based systems avoided some of these issues but suffered from resource constraints and lack of flexibility in modifying exercises.

In response, we developed EDURange (https://edurange.org/), which is a public cloud-based framework for cybersecurity exercises that addresses both student and instructor perspectives. We've held faculty workshops, including one in March 2017 at the national ACM Special Interest Group on Computer Science Education (SIGCSE) conference. The participants we spoke with were enthusiastic about using EDURange. We've also used this framework in many classes; our surveys indicate that the students enjoyed the exercises.

BENEFITS

EDURange is easy to access and provides feedback to students and faculty, aiding in the assessment of student learning. By providing interactive, competitive exercises, it enhances the quality of instructional material while increasing active learning for students. EDURange has the following qualities:

- It's engaging. Students from various backgrounds can learn practical security concepts, tools and skills in puzzle-like scenarios involving realistic challenges.
- Scaffolding and assessment supports students in achieving learning objectives.
- It's easy for students and instructors to use. Scenarios run on VMs created in Amazon Cloud using scripts. Students don't need special software, EDURange can be used anywhere with Internet service. Instructors register their students, often grouping them into teams with accounts on the same VM, which facilitates collaboration. The EDURange system collects data to make assessment easier. Bash history visualizations allow quick determination of progress and whether additional guidance may be helpful.
- It gives instructors the flexibility to use simple scripts to specify exercises at a high level and create variations. This lets them tailor exercises to their classes and modify exercises to minimize the risk of students finding the answers online.

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Yes, this innovation is transferable to other institutions.

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