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## A Look into Increasing the Number of Veterans and Former Government Employees Converting to Career and Technical Cybersecurity Teachers

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## **A Look into Increasing the Number of Veterans and Former Government Employees Converting to Career and Technical Cybersecurity Teachers**

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Dr. Vukica Jovanovic is a Batten Fellow and an Associate Professor of Engineering Technology in the Mechanical Engineering Technology Program. She holds a Ph.D. from Purdue University in Mechanical Engineering Technology, focuses on Digital Manufacturing, Magistar (Ph.D. candidate) degree in Industrial Engineering and Management, focused on Production Systems Design, and dipl. ing. degree in Industrial Engineering focused on Mechatronics, Robotics, and Automation. She went through engineering pathways herself, completing master electrician degree when completing Technical School in Uzice, Serbia, focusing on the pre-engineering program on high power voltage systems and maintenance of electromechanical systems. Her research is focused on engineering pathways, career and technical education, digital thread, cyber-physical systems, mechatronics, digital manufacturing, broadening participation, and engineering education. She is a Director of Mechatronics and Digital Manufacturing Lab at ODU and a lead of Area of Specialization Mechatronics Systems Design. She worked on projects focusing on digital thread and cybersecurity of manufacturing systems as a Visiting Researcher at Commonwealth Center for Advanced Manufacturing, Disputanta, VA. She has funded research in broadening participation efforts of underrepresented students in STEM funded by the U.S. Department of Education, focusing on computer science and cybersecurity pathways, and from the Office of Naval Research, focusing on mechatronic pathways. She is part of the ONR projects related to the additive manufacturing training of the active military. She is also part of the research team that has multiple projects funded from NSF focusing on veteran pathways and their success in engineering. She leads the team that delivers the summer program to nine graders that focus on broadening the participation of underrepresented students into STEM (ODU BLAST), funded by the Virginia Space Grant Consortium.

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Dr. Linda Vahala received her B.S. degree from the University of Illinois in 1969, an M.S. degree from the University of Iowa in 1971, and a Ph.D from Old Dominion University in 1983. Her publications include articles in both plasma physics and atomic physics with an emphasis on laser interactions with plasma and with neutral/rare gas collisions. She has presented her work at various international workshops and meetings, both in Europe and in the United States. She is currently Associate Professor of Electrical and Computer Engineering at ODU. In 1995, she received the Peninsula Engineer of the Year award.

# **A Look into Increasing the Number of Veterans and Former Government Employees Converting to CTE Cybersecurity Teachers**

## **Abstract**

The current state of technology with recent explosions in the digital processing of paperwork, computer networking use, and online and virtual approaches to areas, which until very recently had traditional and non-computerized ways of operating, led to a steady increase in the demand for jobs in the area of computer science and cybersecurity. The education system, the pipeline for the incoming workforce, needs to keep up with this tremendous pace in technology and the job market. The current K-12 school system has been extensively challenged to fill out necessary positions in order to address the increasing need for programs that respond to industry and government entity gaps in employment. The COVID-19 pandemic forced a large segment of the economy to swiftly move to virtual working and virtual learning. This further increased the already large demand for cybersecurity jobs and accelerated the pace at which the development of necessary education pathways is required. The education system, on all different levels, needs to adjust to this pace in order to enable a large number of future graduates to fill these new jobs. There is currently a large gap in the number of K-12 level teachers available in the area of career and technical education. One possible solution to this problem may come from a specific segment of the workforce, veterans. This paper will provide an overview of different challenges that many veterans are facing after joining career switcher programs for future teachers.

## **Introduction**

Digital transformation is leading to a shift in many current jobs. Cybersecurity has become part of any virtual job [1], which became quite clear during the Covid-19 pandemic. The pandemic also led to more openings for cybersecurity professionals, as well as a huge growth of that specific industry sector since there was a large rise in the possible number of cyber threats due to virtual work environments [2-4]. Various researchers have pointed out that organizations had different levels of cybersecurity readiness in place, which led to various vulnerabilities to cyber-attacks [4, 5]. Common IT literacy requirements have risen from the regular in-office workplace with secure networks and enterprise driven workstation to the need for an increase in data access or administrator rights required, issues related to the downloading of sensitive information, forwarding work emails to personal accounts, or less secure document sharing [2, 6].

At the same time, entry-level job qualifications in the area of cybersecurity can be obtained in various ways, such as by learning in-demand skills, earning industry certifications, and graduating with a college degree [7]. The nature of jobs in the cybersecurity industry needs constant updating in relation to developments in IT technologies, various software operations, different programming languages, cloud-based services, and all other areas that are important for these occupations. One research analyzed around twelve thousand entry-level job postings for

cybersecurity jobs on Dice.com to determine required and desired qualifications, including the 29% of jobs that require a certification and around 60% that need a college degree [7]. Some of the most common certifications in cybersecurity industry are "Information Technology Infrastructure Library ITIL" (listed in 3.9% of jobs), "Security+" (listed in 2.9% of jobs), and "Information Assurance Technical IAT" (listed in 2.4% of jobs), amongst others [7].

Other researchers have identified mentoring as an important component for development of future cybersecurity professionals by embedding career guidance, academic advising, as well as guidance and mentoring in research, certifications, service learning, ethics, professional skills, and extracurricular activities [8]. Therefore, engaging students in competitions like Cyber Patriots and exposing them early on to project-based cybersecurity activities might have a huge impact on their future cybersecurity careers.

## **Background**

The Commonwealth of Virginia is trying to address the growing need for cybersecurity professionals by having cybersecurity programming across all different levels of education, starting in elementary school. Various Standards of Learning focused on computer science are embedded in elementary school curriculum. Starting from middle school, students who take Career and Technical Education courses are exposed to different areas of technology. During high school, students enrolled in the cybersecurity pathway are under Business and Informational Technology career clusters. Old Dominion University is currently working with all five high schools from Norfolk Public System to develop educational modules for courses, such as Informational Technology Fundamentals, Cybersecurity Fundamentals, and Cybersecurity Operations. Old Dominion University faculty from the Batten College of Engineering and Technology and the Darden College of Education and Professional Studies are working with CTE teachers to develop educational modules, workshops for CTE teachers, and other supporting events, such as visiting speakers, Code Nights, and industry trips, so that teachers can be better prepared to teach these ever-changing topics to the future cybersecurity workforce. CTE teachers who had previous careers before joining the teaching pathway report teaching as a new life for them and need continuous support to enhance their commitment and motivation in the teaching profession [9]. Hence, these other activities are very important to increase their engagement and retention.

Demand for these courses is growing from year-to-year making it difficult to fill in the spots for the number of CTE teachers needed for these positions [10]. These problems are especially prominent in urban areas with a highly diverse student population, especially in economically disadvantaged areas in which there is a high dropout rate at CTE high schools [9]. Some of the problems related to the high dropout rates is the sense of nobility that previously existed in association with the teaching profession. As well, teachers who had a previous career before joining the education workforce report higher job satisfaction rates because they are teaching students things related to their previous job experiences [9].

One of the biggest problems is related to the financial aspect of the current K-12 salary structure, which is very different from a regular job in the IT/cybersecurity area. Hence, there is a need for more alternative pathways in getting more CTE teachers in the workforce. One of these pathways is through career switcher programs that are available for veterans who are looking for a second career related to education.

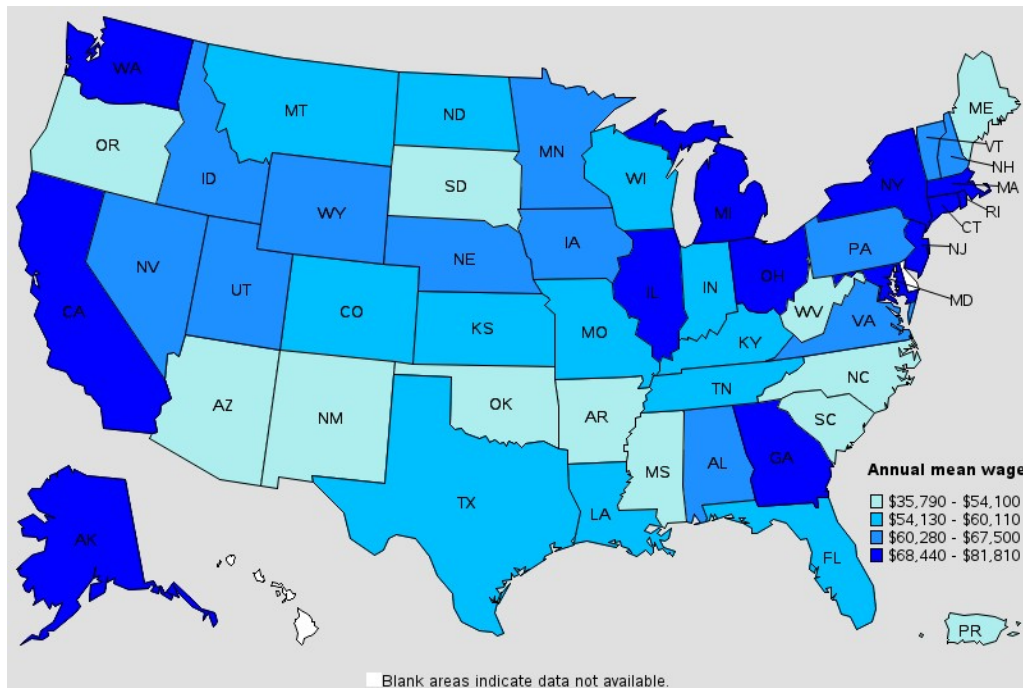


Figure 1: Annual mean wage of CTE teachers, secondary school by state, May 2019 [11]

### CTE Teacher Shortage and Career Switcher and Teacher Licensure Programs

There has been a reported shortage in the general K-12 teacher workforce, but more specifically in the lack of CTE teachers, especially for new fields like cybersecurity since cybersecurity programs are newer. Usually, CTE teachers complete their four-year long bachelor education, which includes all necessary coursework and fieldwork for their successful licensure. However, there are not enough students currently enrolled in these programs, and many of these programs have continued low enrollments, especially in comparison to the current demands for these professionals [12]. CTE teacher shortages have led to the developments of alternative certification and licensure pathways across the United States [13]. Different states have different components related to the CTE teacher shortage: required academic degrees, required work experience, mandated testing, and the length of the program, which may vary from state to state [13, 14]. For that purpose, various universities are offering teacher licensure programs that can assist nontraditional pathways to teaching and increase the numbers of CTE teachers [13]. Based on a study done by Zirkle & Jeffery in 2017, sixteen states require a CTE administrative credential and eighteen universities offer CTE administration credentialing [14].

## **Translation of Military Skills into Civilian Teaching**

Military veterans have various skills pertaining to CTE teaching to include valuable nontechnical skills like leadership, decision-making, persistence, and attention to detail [15]. In terms of technical skills that are related to their CTE teaching area, they have technical, on-the-job experience. Some researchers suggest that themes like resilience, change, and self-differentiation are important in the transitioning process for veterans [16]. Also, not all veterans transitioning are at the same military rank level. They come from all different branches of the military and some have worked at the mid-level or senior enlisted to junior and mid-level officers, thus their transition to civilian careers can have completely different challenges and pathways. Also, different jobs might fit different MOS/specialties better since they all have different sets of skills.

## **Different Entry Programs for Veterans who would Join CTE Workforce**

The U.S. Department of Defense and the U.S. Department of Education founded the Troops to Teachers (TTT) program to assist veterans' transition into teaching careers after completing their military service [17]. Troops to Teachers, founded in 1993, is assisting career switching service members and veterans in beginning new careers as K-12 schoolteachers in public, charter, and Bureau of Indian Affairs schools [18]. They provide service members and veterans with counseling and referral services and advise them towards completion of their educational and licensing requirements needed to become and secure a teaching job [18]. So far, they have helped more than 100,000 to transition to the teaching career [18]. The program is open to all transitioning military veterans who will be, or have been, honorably discharged and have a B.S. degree or alternative training [17]. These are the steps that are required to complete this program: 1) Registration; 2) Meeting with the counselor and action plan creation; 3) Pass Praxis exams or state exams for teacher credentials; 4) Pass background check and screening; 5) Complete student teaching hours; 6) Apply for state certification; 7) Create a resume, cover letter, and list of references; 8) Search for jobs by state; 9) Attend job fairs or TASC events; and 10) Start working as a licensed teacher [17]. The program is scheduled to phase out by October 2021 [18].

## **Veterans to Teachers in Commonwealth in Virginia**

The Commonwealth of Virginia requires 18 credit hours of courses related to the teacher certification [19]. There are eight broad career and technical education (CTE) areas: Agricultural Education; Business and Information Technology; Family and Consumer Sciences Education; Health and Medical Sciences Education; Marketing; Military Science; Technology Education; and Trade and Industrial Education [19]. Additionally, certifications, such as COMPTIA A+, might be required to teach cybersecurity courses [19]. Five different universities in the Commonwealth of Virginia currently provide career switcher programs [20].

Some veterans, who have already transitioned to being a teacher, noted that they wish they had known about some requirements for teaching certification, so they could complete these before

the transitioning [21]. They also mentioned that salary and benefits related to teaching jobs are substantially less than military pay and benefits, and they noted that availability of such programs is scarce across the nation [21]. Some recommendations were related to the development of national standards that would be transferable across the state borders for CTE certification, as well that colleges and universities that operate on military installations could open such training programs [21].

The Commonwealth of Virginia has 738,635 veterans [11] in its 8.6 million population, which makes it seventh in the nation in the number of veterans per population. Old Dominion University is located in close proximity to a large veteran's population. The College of Engineering, for example, has 262 students who are veterans and 218 students who are active-duty personnel, which makes 480 of 3,180 students. Old Dominion University currently offers a Career Switcher program, which is enabling the professional workforce to take 18 credits of all necessary courses and exams to gather all three different levels that are needed for certification for a job as a Career and Technical Education teacher [22].

### **CTE Teachers as After School Cyber Patriots Coaches**

Cyberpatriot is the National Youth Cyber Defense Competition for high school and middle school students. Student teams act like newly hired IT professionals tasked with managing the network of a small company. The competition consists of multiple online competition rounds. Students have to navigate through a set of virtual operating systems. Their task is to find and fix cybersecurity vulnerabilities while maintaining critical services. The best teams win a paid trip to Maryland for the National Finals Competition to compete for national recognition and scholarship money [23].

For the 2020-21 school year, Granby High School's Cyber Patriots team was sponsored by Retired Master Chief Michael Dyer. He is one of two Military Science instructors at the school. Due to COVID restrictions, the school system did not sanction in-person meetings. The team met virtually and Master Chief Dyer distributed laptops. All Cyber Patriots' challenges were conducted virtually. This year, round 3 served not only as the State Championship Round, but also as the final qualifying competition before the National Championships. The round was very challenging, featuring wrinkles and twists that were not seen in Rounds 1 & 2. Of the Area 5 teams, at the Silver Level, Granby High School - Cyber Comets placed third. Students and teachers, seen below, received 10 high performance laptops, which are purchased according to the Norfolk Public Schools IT specification. They were funded by a grant from the U.S. Department of Education.

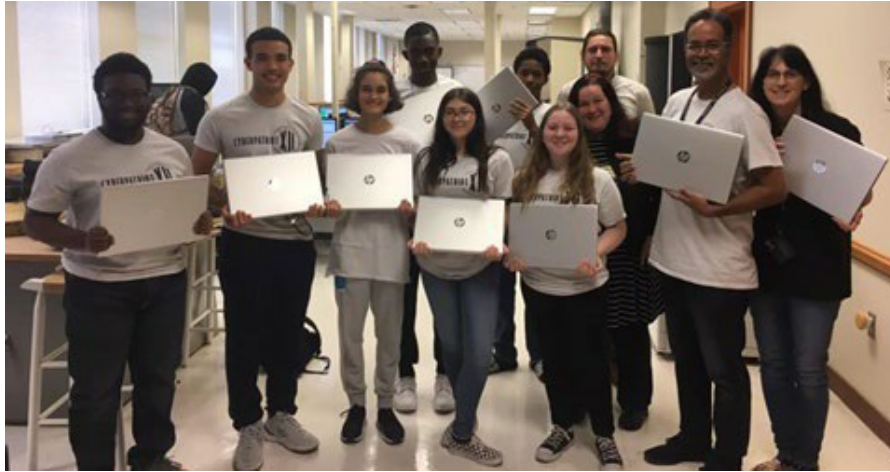


Figure 1: Blind Review Cyber Patriots CTE students team led by Mr. Blind Review pictured here, second from the right, U.S. Air Force veteran and Chair of Granby School Career and Technical Education Department

In this way, students have access to updated technology and a real world, experiential learning experience. They acquire skills needed for their future employment. Veteran teacher coaches provide valuable leadership, guidance, attention to detail, and professionalism, which are all highly sought by the industry. Soft skills go beyond just regular classroom experience and participation in such experiences is beneficial to both students and teachers.

## Conclusion

After departing the military, veterans have a broad range of needs in terms of future careers. A good number of them join the Career Switchers programs, in which they establish new skills and get training to become future career and technical education teachers. However, current curricula in career switchers programs focus on pedagogy and classroom management skills. There is a gap for training of teachers focused on cybersecurity education and obtaining certifications, such as CompTia A+, or Security+, needed to teach in this specific area of CTE education. The bigger issue is that some of the existing programs, such as Troops for Teachers, are set to be phased out this year. The gap still exists in the area of CTE education. Future programs would need to address the need for national certification so that teachers could move from across state borders. Another large issue many veterans noted relates to the salaries and benefits of teaching jobs. Lastly, some veterans who went through such programs suggested that future careers and required certifications should be mentioned and considered before they transition to the civilian workforce.

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