

ALTERNATIVE CREDENTIAL TRAINING IN CYBERSECURITY: AN EXPLORATORY
STUDY OF THE NEXUS CERTIFICATE AND DEGREE IN CYBERSECURITY

By

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Alternative credential training in cybersecurity: An exploratory study of the Nexus Certificate and Degree in Cybersecurity

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Abstract

The emergence of new credentials is changing the landscape of traditional post-secondary education. The tight labor market's rising demand to fill vacancies in high-demand career fields such as cybersecurity has led to so-called "alternative credentials" to rapidly upskill and reskill existing professionals to move into the industry. Alternative credentials potentially provide an added source of talent by tapping into alternative sources of education for historically underserved or previously unreached populations. The University System of Georgia (USG) created the Nexus program in response to industry demands in several high-demand fields. One of the first Nexus degrees to be submitted by a university was the Nexus Degree in Cybersecurity of FinTech. The university later added a Nexus Practitioner Certificate in Cybersecurity of FinTech to their program. This study surveyed students and industry on the impact of this alternative credential program to rapidly educate a diverse cybersecurity workforce to fill local hiring demands. Analysis indicates the program is successful in providing students the necessary knowledge, skills, and abilities (KSAs) that the industry demands for entry-level cyber professionals and is opening opportunities to previously underserved and unreached populations to fill those demands.

Keywords: Alternative credential, micro credential, microcredential, cybersecurity, Nexus degree, Nexus practitioner certificate

Introduction

Traditional, credentialed university degrees represent the primary method by which the majority of students are educated in the U.S. One reason most frequently cited for the growing number of cybersecurity lapses in the U.S. is that there are not enough individuals with the appropriate degree, knowledge, skills, and abilities (KSAs) as well as experience for industries to hire (Legg, 2021). Unfilled entry-level cyber professional jobs across the nation number more than 715,000 according to the Cyber Seek website (2022). This shortage of cyber professionals combined with increasing cyber risks posed by fast-paced emerging technologies such as the Internet of Things (IoT) necessitates alternative learning paradigms to fill the cyber gap. According to Msweli et al, (2022) research on the plausibility of alternative credentials to support the development of dynamic skills for “an increasingly impatient and rapidly changing digital world” has been on the increase (p. 1). Blazevic (2020) defines alternative credentials as certification-style programs individuals study to improve or learn a particular industry area skill. Laiteerapong and Huang (2015) state alternative credentials also serve to certify/recognize the achievement of an individual’s specific new knowledge or skills.

Several universities have been working to fill the cybersecurity hiring gap by offering alternative degree and certificate programs. Greenberg (2018) states that the demand for alternative credentials – “including micro credentials, micro masters, nanodegrees, badges, boot camps, and short-term certificates” – is appropriate for our times (p. 1). Many of these new university alternative credentials are credit-backed and stackable, providing not only value to students as a standalone credential but as a means of applying for credit down the road toward an associate's or bachelor's degree (Ascione, 2020; Banhan, 2022; Kehoe and Goudzwaard, 2015; Lok et al, 2022; Mangan, 2015). In addition, the composition of America's cybersecurity workforce does not traditionally reflect the makeup of its population. The number of women, African American, Hispanic, and other minority employees engaged in cyber work is way below the

proportions of the overall workforce (Cronk, 2020). This represents a huge untapped source of talent to fill the gap. A potential benefit of alternative credentials is that they may provide a means to tap into an alternative source of talent by opening and accelerating access to education for historically underserved and previously unreached populations.

The Nexus program sprang from a University System of Georgia (USG) initiative that sought to refine the delivery and accessibility of public higher education to meet 21st-century learning and careers by developing a unique, short credential designed to provide intensive preparation for high-demand jobs. The Nexus Degree and Certificate in Cybersecurity was one university's response to meet the needs of local Fortune 100 and 500 companies' cybersecurity talent needs.

Problem Statement

The demand for cybersecurity professionals to secure systems and processes continues to grow at a rate faster than companies can hire and traditional institutions can turn out. While the number of universities and technical colleges that offer cyber-related degrees has grown over the last few years, those credentials do not necessarily indicate whether someone has the necessary knowledge, skills, and abilities (KSAs) and motivation to accurately identify and block attackers without additional training and support from their employers or other training resources. This adds additional time and expense to the hiring process and delays in securing the business (Banhan, 2022; Keellihir, 2022; Seltzer, 2022). Can a university-backed alternative credential be part of the solution to provide skilled cybersecurity professionals in a relatively short time? In addition, can the program provide a means to tap into previously underserved and unreached talent to help fill the critical hiring gap?

Purpose of the Study

The purpose of this exploratory study is to examine the Nexus Program as an alternative credential designed to rapidly educate and skill a diverse cybersecurity workforce. One of the effective strategies to mitigate the shortage of cybersecurity professionals is to reach a wider audience of students including women, minorities, and those looking for non-traditional career education paths such as career-changers, exiting military, recently graduated high school students as well as those professionals in IT and related fields that want to upskill or reskill into a cyber profession. Specifically, this paper attempts to address a gap in the literature regarding university-sponsored cybersecurity alternative credentials such as the Nexus program.

Research Questions

- Q1. Is the Nexus Certificate and Degree a viable alternative credential to meet the training needs of a diverse population in achieving employment in cybersecurity?
- Q2. Is the Nexus Certificate and Degree a viable alternative credential to meet the hiring needs of companies to fill their cyber professional employment gaps?
- Q3. What are the components that make the Nexus Certificate and Degree an attractive alternative credential for training to meet the cyber professional needs gap?

Review of the Literature

According to Lim et al (2018), it is time for a new kind of credential – an alternative credential. Alternative credentials represent competency outcomes earned through learning that are based on non-degree activities.

Alternative credentials were little discussed in research as little as four years ago (Matkin, 2018; Choudaha, 2019; Bull, 2015). A systematic literature review of the multidisciplinary electronic academic databases ACM Digital Library, Google Scholar, IEEE Xplore digital library, Science Direct, and Scopus of articles published between 2011 and 2020 was conducted by Msweli et al (2022). The authors searched using the terms, “micro credential*”, “micro-credential*”, “digital credential*”, “digital badg*”, “credential*”, “beta credential*”, “beta-credential*” using the Boolean operator ‘OR.’ The review returned a total of only 140 unique documents. A more recent search by Wolz et al, (2021) returned a total of 147 documents.

The found literature demonstrates the relevance of alternative credentials with Bull pointing out that “a college diploma is not the only way to the good life, the intellectual life, the cultured life, or the American dream, and it is elitist to push for an educational ecosystem in which college is the only route” p. 5). Seltzer (2022) posits that micro credentials are the future of higher education.

The idea of alternative credentials has been around since 2012 when universities in Germany, Australia, and the U.S. participated in a Higher Education Institution (HEI) pilot project (Kato et al, 2020). HEIs discovered that by offering alternative credentials they could experiment with new pedagogies and technologies and increase responsiveness to student and labor market demands all while increasing university visibility and reputation, reducing costs, and generating additional income (Jansen and Schuwer, 2015). Creating alternative credentials that are credit-backed and stackable allowed working learners the ability to apply credit towards a traditional degree program in the hope that these same learners will continue their formal education in the future (Mangan, 2015). In addition, alternative credentials helped to improve the quality of existing HEI educational offerings by experimenting with new technologies and pedagogies resulting in flexible distance-enabled (online) education offerings (Allen and Seaman, 2015; UNESCO and Commonwealth of Learning, 2016). Finally, alternative credentials enabled HEIs to offer highly targeted training to provide the skills that local labor demands; increasing the efficiency of HEI systems over traditional degree programs while being a force for innovation and creating a new way for HEIs to reach new learners literally around the globe (Kato et al, 2020; Fain, 2018; Strada Education Network; Gallup; Lumina Foundation, 2019; The Chronicle of Higher Education, 2019)

Over 60% of the 190 respondents to a U.S. HEI study reported that alternative credentials are an important future strategy with more than half seeing them as a supplementary source of income, and nearly 40% believing that they represent a better way to serve their constituencies (Fong et al, 2016). This constituency referred to attracting historically underrepresented groups because alternative credential programs often offer greater flexibility and less cost than formal higher education programs.

Employers today are looking for candidates with more than just a degree. Fuller et al (2022) report that only three percent of employers believe that a university degree is somewhat important (The Chronicle of Higher Education, 2013). Employers are demanding professionals with competencies and KSAs specific to their needs. Students are expected to gain these additional competencies however they best can if a university does not supply them through their regular degree program. To enforce the concept and cultivate life-long learning to include upskilling and reskilling, major companies such as Salesforce and Ernst & Young have embraced alternative credentials in their organizations (Salesforce, 2013). Therefore, for universities to be responsive to the changing needs of employers and job seekers they need to create a learning environment where specific, in-demand knowledge, skill, and ability can be quickly, conveniently, and affordably acquired. The alternative credential can provide a verifiable and transparent system to formalize and

document this type of learning by providing a portable, verifiable mechanism to display competency in new subject areas, coursework, certificates, and degree programs (Priest, 2016; Colorado Community College System, 2014).

The time has come for public-private partnerships between universities and industry to collaborate on alternative credentials that are relevant and offer a practical and affordable way for students globally to earn meaningful skills focused specifically to meet today's tight labor market. Employers, employees, and job seekers seek a credential that is affordable and can be earned not in years but in just weeks or months. It needs to be built with employer input, awarded by a university, and verifiable by other employers and universities (Kehoe and Goudzwaard, 2015). This initiative by HEIs will be an important means of supporting and preparing well-rounded students with highly marketable skills to meet industry expectations and demand (University Learning Store, 2018).

Besides providing a practical evidence-driven methodology where the provider and learner manage their "learning experience using clear criteria, evidence, and methods in a very transparent manner," alternative credentials provide a means to differentiate students from their peers with the same university degree (Lim et al., 2019, p. 1)). In a tight and competitive labor market job applicants who earn alternate credentials, similar to the attainment of highly recognized industry professional certifications, will stand out from other job applicants (Johnson, 2018).

These new credentials can serve as an "alternative" to attract individuals who are traditionally underrepresented or underserved by more traditional higher education programs. For example, the Google IT Support Professional Certificate takes just eight to twelve months to complete and costs just \$49 (USD) per month (Burke, 2019). Google provides refugees, students from low-income backgrounds, and veterans with scholarships. Once earned, the certificate is shared with a consortium of more than 20 major employers (Fain, 2018). Over half of the learners that enter the program do not have a bachelor's degree. Keelliher (2022) estimated that 250,000 new cyber professionals from previously untapped resources entered the workforce from such programs between 2020 and 2021 but the need also grew by 30% leaving the gap unaltered.

Scientific and policy documents defining alternative credentials are still in the early stages of development. A literature review by Cartis et al (2022) shows that further research is needed to define what alternative credentials are and how to create a coherent approach to how they can be integrated into education, especially regarding meeting current and future high-demand career areas (such as in the field of cybersecurity). In summary, alternative credentials are still ambiguous and underutilized.

Methodology

Study Design

The study is an exploratory qualitative study. Subject interviews were conducted in a semi-structured manner and included a sample of students, industry participants, and employers associated with the Nexus Certificate and Degree in Cybersecurity program.

Study Subjects

A total of 117 students (seven cohorts) have participated in the program since its inception fall of 2020. Cohorts five through seven, composed of 71 students, are currently enrolled in the program. Cohort seven started in January 2023.

The following students participated in the study:

Cohorts one through four

- A student that left the program halfway through to take industry employment in cybersecurity
- Two students that took employment halfway through the program but returned to graduate with the Nexus certificate. One of which went on to achieve a B.S. in Cybersecurity
- One student who completed the program and graduated with the Nexus Practitioner's Certificate

Cohorts five through seven

- Two students from cohort five
- One student from cohort six
- Seventeen students from cohort seven

Six industry participants were interviewed, all of whom were integral in the program's formation and five of whom still actively participate in some combined manner as guest lecturers, mentors, mock interviewers, program advisors, competition coaches, or industry professional association representatives.

Information about the program including its origin, history, and overall demographics was provided from school records and discussions with program originators. The release of university information was approved by the college dean, department chair, head of enrollment, and past and current Nexus instructors. All were provided with a copy of the project proposal and IRB approval. No student identifiers were provided with overall demographic information.

Data Collection

A semi-structured approach was used to collect data from participants. Questionnaires prepared a priori were provided in advance to aid participants in thinking back on their experiences with the program (Appendix A and B). The questionnaires were developed based on the researcher's experience and literature review covering a range of topics related to the alternative credential program. The questionnaires were reviewed by university personnel experienced with the program and piloted to ensure relevance to the subject and question clarity. A general definition of alternative credentials was provided to participants with instructions to focus on the alternative credentials presented by the Nexus program of study. Participants were provided an opportunity to speak at length about:

- views on and experience with the program,
- university support for students and the program,
- ability of the program to reach and serve a diverse population of students
- ability of the program to address local market demand,
- program viability, challenges, and opportunities, and
- ideas on program improvement

Each participant was provided the opportunity to meet face-to-face or answer their specifically focused questionnaire (Appendix A or B) based on their schedule availability. Demographic data, past industry experience, and current employment status were collected. Microsoft Teams was used to interview, record and transcribe verbatim face-to-face interviewees with each interview lasting approximately 20 minutes. Participants were informed that no compensation would be provided, the study was IRB approved and they could ask to stop the interview at any time. All participants were over 18 years of age and signed a release.

Data analysis

A general inductive approach (GIA) was used to analyze responses (Thomas, 2006). After data collection was complete, but before coding began, all participant responses were reviewed to gain a sense of the emergence of dominant themes and links between research objectives and findings. The interview guide provided a framework to aid in initial coding. Data relevant to the study in interview transcripts were coded rather than coding responses line-by-line. Further analysis of patterns and relationships that emerged from the data allowed critical insights to be gleaned from similarities and differences in the responses. Coding and theme identification involved an iterative process. Themes and sub-themes were grouped into a mind map for visualization of findings (Wheeldon & Faubert, 2009; Creswell, 2009).

Research Findings

Nexus Certificate and Degree

In 2014 and 2018, the *Governor's High Demand Career Initiative Report* (Deal, 2014), the *2018 State of Georgia's Fintech Ecosystem* (TAG and Georgia Tech Financial Services Innovation Lab, 2018), and the *College 2025 Report* (Wrigley, 2018) were among several studies encouraging the USG to address specific industry work role shortages within the state. In response, the University System of Georgia created a means to refine the delivery and accessibility of public higher education to meet 21st-century learning and careers and named it Nexus. The unique, short, alternative credential allowed universities to voluntarily develop a program that nimbly and specifically addressed workforce needs in their community.

The Nexus program emphasized the creation of strong public-private partnerships, skilled knowledge, and hands-on experience in high-demand fields such as cybersecurity (University System of Georgia, 2023). A Nexus degree requires 60 credit hours, consisting of 42 credit hours of general education and 18 credit hours of coursework, and is credentialed as an associate's degree. The 18 hours of subject-specific coursework is composed of six hours of experiential learning in the form of a hands-on apprenticeship and 12 credit hours of upper-division technical coursework. Kafka (2018) notes that the Nexus is the first new accredited credential introduced in the U.S. since associate degrees were first awarded in 1898. All earned credit hours can be applied to a bachelor's degree program.

The Nexus in Cybersecurity was created based on the direct input of primary industry constituents including TSYS, Aflac, Delta Data, W.C. Bradley, Synovus, Columbus Chamber of Commerce, and Fort Benning command staff. Input included high-demand technical and professional "soft" skills (Newswise, 2019). The university employed *The National Institute of Standards and Technology (NIST) National Initiative for Cybersecurity Education* (NICE; Newhouse, Keith, Scribner, & Witte, 2017) framework to match cybersecurity work roles to the most noted industry technical KSA requirements. The KSAs aligned to the Cyber Defense Analyst work role.

The USG approved the university's application for a Nexus Degree in Cybersecurity in February 2019. A Nexus Practitioners Certificate that could be completed in 12 months and based only on the 18 hours of cybersecurity-specific coursework was approved in the fall of 2019. Recruitment of participants began in the fall of 2019 (DeMuth, 2019) and was primarily achieved through a rotating banner on the university's main web page. Interested enrollees went through a selection process that included an orientation and interview before being allowed to apply for the program. Once approved, a background check was performed to qualify candidates to apprentice in Fortune 100 and 500 industry security operations centers. Developers of the Nexus program stated approximately 75 potential attendees vied for just 20 first cohort spots. A commitment to four hours a day, in-person, intense, hands-on rigorous program was emphasized to all applicants. A start date of March 2020 was set for the first cohort. The onset of the Covid-19 pandemic

in March 2020 impacted the initial Nexus start date and enrollment interest due to the program's in-person, hands-on learning focus.

The inaugural cohort began on August 4, 2020, with 13 students (Columbus State University, 2020). Thirty-three additional students were enrolled over the following three cohorts. The resurgence of the Delta Covid variant canceled the summer 2021 cohort. Each cohort moves together through the 12-month Nexus Practitioner's portion of the program together. Students who have met the 42 hours of general education courses by way of a previous degree are awarded both the Nexus Certificate and Degree upon graduation. Those who earn the certificate and go on to achieve the 42 hours of gen-ed are awarded the Nexus Degree later. Twenty-three of the 46 enrollees in the first four cohorts graduated from the program. The remaining 71 students are still moving through the program in cohorts five through seven.

Reasons for not completing the Nexus program

Discussions with program developers and interviews with students from the first four cohorts found that students left the program for one of four reasons:

1. A major life or economic change such as a military spouse move, divorce, or sudden need to earn additional income.
2. A realization that the cybersecurity profession was not as imagined resulting in a loss of desire to finish.
3. Inability to pass the rigors of the program, primarily the industry certification exams that serve as gates to even more challenging program training and instruction leading to the next certification. Students were awarded tutoring and additional opportunities to retake the failed exams before being encouraged to exit the program. Several went on to enroll in a non-technical bachelor's program.
4. In the initial year of the program, several students applied for cyber internships and co-op positions outside the formal Nexus apprenticeship process of the program. Nexus students with as little as six months of training and a couple of industry certifications won out over applicants pursuing a bachelor's. The Nexus student's superior job performance resulted in an immediate hire offer and therefore, the student not returning to the program. A serious discussion was held with industry constituents resulting in an end to program poaching.

Reaching a Diverse Population

Figure 1 represents Nexus program demographic information as calculated from university-supplied information. Of the 117 participants to date, 44 percent (52 total) represented traditionally underserved populations such as Black, Asian, and Hispanic. Women made up 20 percent (23 total) of the cohort population.

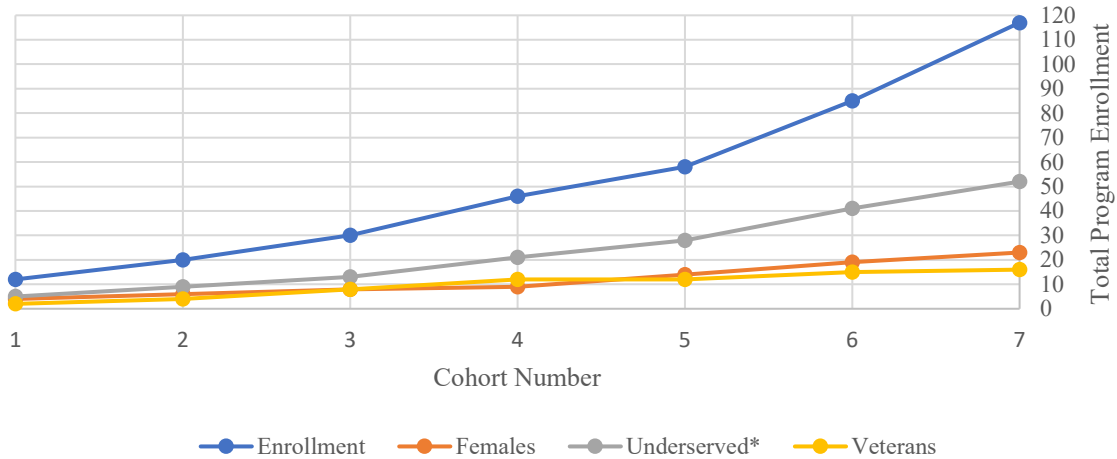


Figure 1: Nexus Program Demographic Information Since Inception (Seven Cohorts)
 *Female demographic totals are also included as part of the underserved demographic totals.

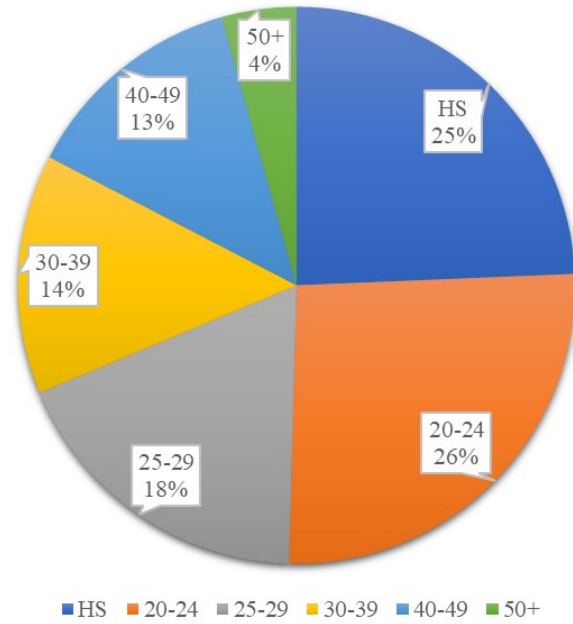


Figure 2: Nexus Program Age by Percentage Since Inception (Seven Cohorts)

Figure 2 represents the 117 student’s age diversity. Twenty-five percent of enrollees were 17 to 19 years of age and entered the program straight from high school (HS). When applying to the program they noted the attractiveness of twelve months to a well-paying career without having to obtain a four-year traditional degree. Another interesting note is that 49 percent of the students were 25 or older representing a population of individuals that entered the program for a new career, upskilling, exiting a military career or returning to the workforce after a pause to raise a family. The first cohort included a cruise ship pastry chef, a music major, a former high school art teacher who had paused her career to raise a family, a twenty-year IT professional from Vietnam who after three years in the U.S. could not get employment because he had no recognizable certifications, a female veteran who had spent the last 14 years working for the VA and a successful local small business owner of twenty-five years. The businessman had no previous IT or cyber experience, was over 50 years old when he entered the program, and graduated with the highest pay offer

of any graduate to date (\$82,000), the music major was the second highest paid graduate. The diversity in age and stage of life points to the Nexus' attractiveness to a population of individuals that might otherwise have never considered a career in cybersecurity. It also points to local socio-economic benefits because students were recruited, trained, hired, and retained locally for high-paying jobs rather than local companies having to recruit from abroad.

Of the 23 initial graduates, two were female, two were recent high school graduates, eight represented underserved populations and two were military veterans.

Components of the Nexus Program

The following thematic map (Figure 3) captures participant responses related to the program's attractiveness. It visualizes what first attracted applicants as well as what kept/keeps them interested and engaged in the program.

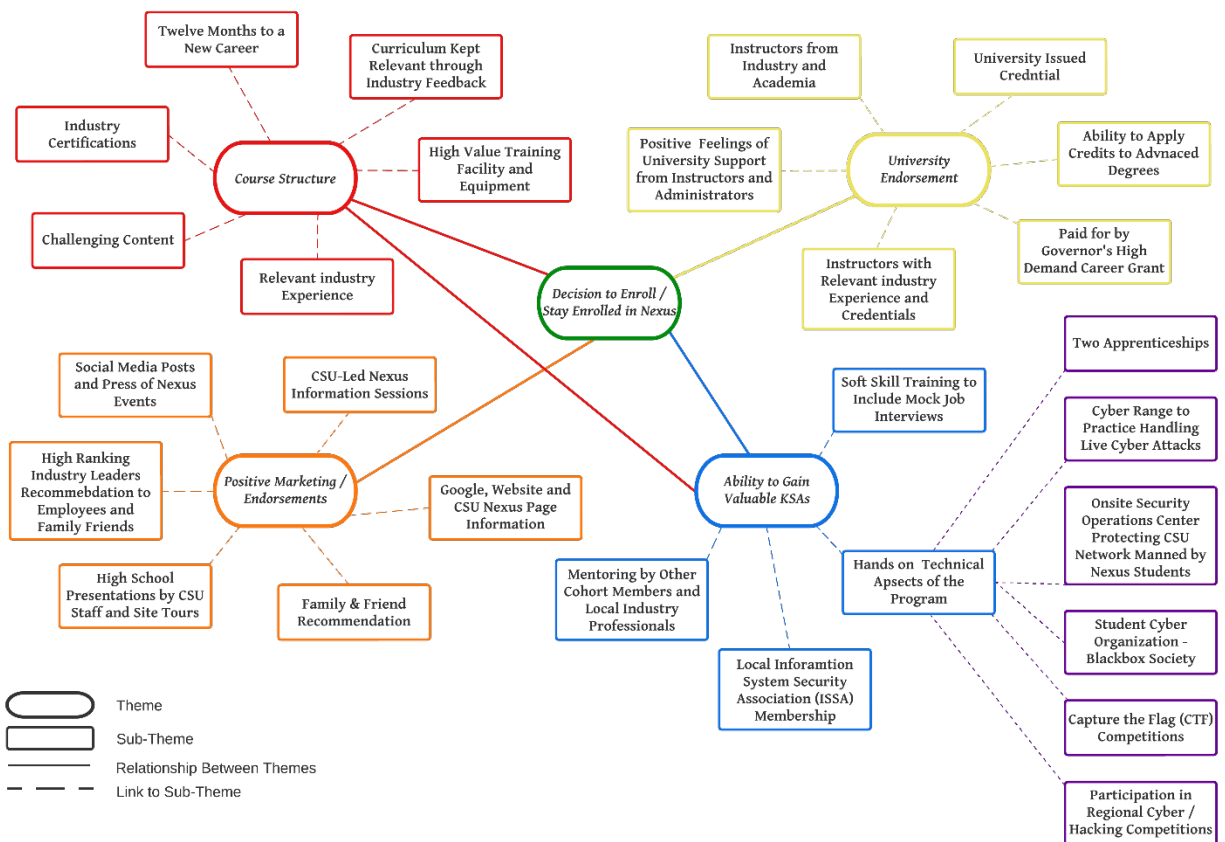


Figure 3: Thematic Mapping of Participant Responses Regarding Nexus Program Components

Industry Participation

Student respondents pointed to industry participation as one of many reasons they were and continue to be attracted to the program. From the beginning, a strong private-public partnership and bond were formed between industry, instructors, the university, and students. This resulted in a focus on the CompTIA® Information Technology+ (ITF+), Network+, and Security+ industry certifications, as well as a pentesting

certification from eLearnSecurity®. This also includes a willingness to apply hands-on training with various high-demand industry tools such as Security Onion, QRadar, Splunk, Snort, Network Miner, Elastic Search, Kibana and FortiSIEM, etc.

Approximately 50 Fort Benning and Fortune 100, 500, and 1000 company professionals participate regularly in the Nexus program. Titles range from HR personnel, department hiring managers, Digital Forensics, Cybersecurity and Security Operations Center Directors, and senior executives such as Executive VP and Chief Information Security and Chief Information Officers. Participation includes program input, regular visits to observe, guest lecturers, mock interviewers, and cyber competition mentors. Student survey participants found the presence of industry to be a positive and encouraging component of the program.

Industry survey participants were quick to point out that the programmatic details of the Nexus program made graduates attractive to meet their company’s hiring needs. Several stated that regular degree graduates lacked the KSAs and understanding of key industry tools required for entry-level cyber roles. In addition, industry participants in mock interviews stated that the soft-skill training was apparent as Nexus students were better prepared both in demeanor and the ability to answer technical questions during interviews over degreed students.

One interviewee used a term that well summarized what others frequently pointed out regarding Nexus students - the "Nexus Triad of Success." These were students who went above and beyond classroom instruction to take on and inculcate new and more challenging cyber skills and abilities while enrolled in the program. This included honing skills through cyber competitions, attending conferences, and participating in university and local professional associations. Students who met this criterion often found themselves under the watchful eye of multiple companies and could expect multiple competitive offers upon graduation. Figure 4 is a thematic map of the so-called Nexus Triad.

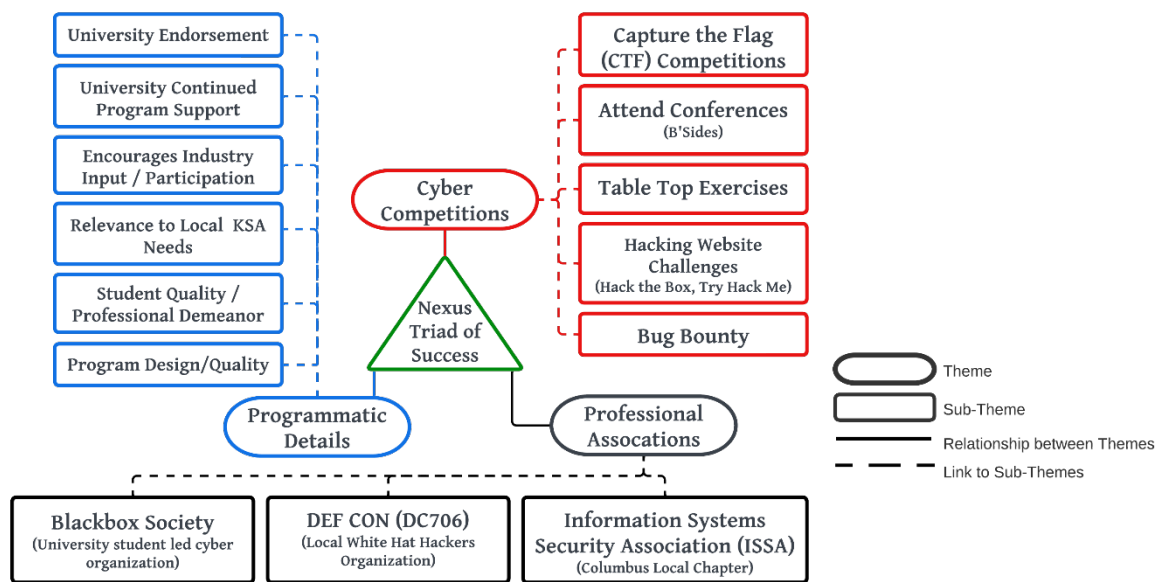


Figure 4: Thematic Map of the Nexus Triad of Success

Conclusions

The USG created the Nexus alternative credential to foster a symbiotic public-private partnership that would forge a rapid pipeline of skilled professionals in high-demand career fields located in tight labor markets. The Nexus program in Cybersecurity is a prime example of this concept successfully playing out in one community. It is a testimony to the strength and necessity of public-private partnerships beginning with the formative stage and continuing through the life of the program. This includes continued input, feedback, and hands-on involvement of industry with academia to keep the program relevant and attractive to students and to local hiring needs.

This study found that, in answer to the research questions, the Nexus program in cybersecurity is a university-endorsed alternative credential that:

- is a viable alternative credential that successfully attracts a diverse population of students from a variety of genders, ethnicities, ages, and stages of life. It was found to attract both an underserved and previously untapped/unreached population as well as have a positive socio-economic impact on the region by recruiting, training, hiring, and retaining local talent.
- is a viable alternative credential to meet the hiring needs of companies to fill their cyber professional employment gaps in a tight labor market as verified by both hiring Nexus graduates and by the enormous amount of effort, input, and enthusiasm the industry shows for the program and its students
- contains components that not only keep students motivated and challenged but frequently motivated to go beyond academic requirements to participate in other outside curricular and professional activities to enhance their technical KSAs – the “Triad of Success.”

Future Work

This study focused on one university’s Nexus program that mapped student KSAs to the NIST Cyber Defense Analyst work role. Future studies might determine if the Nexus program model could attract underserved and unreached populations to successfully fill other high-demand cyber work roles such as in cloud computing security, security analysis and investigations, and application security. These are three roles often cited in high demand across the U.S. (ISSA, 2021).

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Appendix A

Research Questions for Nexus Program Participants

No.	RQ No.	Questions - for students that were enrolled in the program and did or did not finish the curriculum.
<i>Opening Question – Rest of the questions will be used to fill in any gaps not brought up in Question 1</i>		
1	3	Tell me about your experience with the Nexus Program.
<i>Views and Experience</i>		
2	3	How did you hear about the Nexus Program?
3	3	What attracted you to apply to the program?
4	1, 3	Did you decide to pursue the certificate or the degree? What influenced your choice?
5	1, 3	How did the university’s endorsement of the program impact your decision to attend?
6	1	What were your expectations going into the program? What did you expect to get out of the program?
7	3	How supported did you feel by the program? What is your impression of the program from a university support perspective?
8	1, 3	Are you still enrolled in the program / graduated? If not, why – please explain what happened.
8	1, 3	What is/was your overall impression of the curriculum?
9	3	How were the instructors? What did you appreciate / like or not like about them?
<i>Alternate Program Aspects</i>		
10	3	How were the hands-on learning aspects of the program (SOC and Cyber Range)?
11	3	Discuss your experience with the five industry certifications.
12	3	What company did you apprenticeship with and what was your experience like?
13	3	Were you able to participate in another coop, internship or apprenticeship outside the program? Did being enrolled in the program play any role in obtaining these additional opportunities?
14	3	What was your experience during the professional training classes (dress, ethics, public speaking, resume building, mock interviews, etc.)? Did you find them helpful? In what way?
<i>Program Betterment</i>		
15	3	In your opinion, what areas, aspects, items, etc. of the program could use improvement? How do you feel this will enhance the program?
<i>Program Viability</i>		
16	1	Overall program impressions or final comments?
17	1	Do you plan to continue your education? Is so, in pursuit of what? And when?
18	1	How do you think the program prepared you for a career in cybersecurity?
19	1	Have you been able to obtain employment in cybersecurity? If so, in what aspect?

Appendix B

Research Questions for Industry Participants and Hiring Companies

No.	RQ No.	Question - Questions for professionals that interacted in some capacity with the program (program development, mock interviews, teaching or hiring manager).
<i>Opening Question – Rest of the questions will be used to fill in any gaps not brought up in Question 1</i>		
1	3	Tell me about your experience with the Nexus Program in general.
2	3	Tell me about your experience with the Nexus Program students.
<i>Views and Experience</i>		
3	3	How did you hear about the Nexus Program?
4	2, 3	What attracted you to want to help with the program?
5	2, 3	How did the university's endorsement of the program impact your decision to be involved?
6	3	What role(s) have you played in the program - program development, mock interviews, teaching, apprenticeship supervisor, hiring manager or other?
7	2, 3	What is/was your overall impression of the curriculum?
8	3	What is your overall impression of the instructors?
9	2	How do you think the program prepared Nexus students for a career in cybersecurity?
<i>Alternate Program Aspects</i>		
10	2	How valuable to hiring do feel the hands-on learning aspects of the program (SOC and Cyber Range) are to the industry? To get hired?
11	2	How valuable to hiring do feel the five industry certifications are to the industry? To get hired?
12	2	Did your company sponsor an apprenticeship? What was your experience with the student like? Did you make the student a job offer?
13	2	Did your company participate in other coop, internship or apprenticeships outside the program? Did being enrolled in the program play any role in the additional opportunities offered to the students?
14	2	How valuable to hiring do feel the professional development classes were to students (dress, ethics, public speaking, resume building, mock interviews, etc.)? Did you find a difference between these students and other students that were not enrolled in the Nexus program? In what way?
<i>Program Betterment</i>		
15	2	In your opinion, does one of these unique aspects (hands-on, apprenticeship, professional development, etc.) lend itself to making a candidate more attractive to employers than the others? If so, which one(s)?
16	3	In your opinion, what areas, aspects, items, etc. of the program overall could use improvement? How do you feel this will enhance the program?
<i>Program Viability</i>		
17	2, 3	Overall program impressions or final comments? Do you feel something might be missing or could be added to make it more viable?
18	2	Do you plan to hire students from the Nexus program? Why or why not?