

CPAM Consortium TAACCCT Round 4 Grant Evaluation Final Report

**Report to:
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EXECUTIVE SUMMARY

In October of 2014, Montgomery College (Montgomery) received a \$15 million grant award through the United States Department of Labor (USDOL) Trade Adjustment Assistance Community College and Career Training (TAACCCT) program. Montgomery's project, titled Cyber Technology Pathways Across Maryland (CPAM), comprises 14 community colleges across the state of Maryland. The CPAM project aimed to successfully implement five strategies:

- Build an easily navigable statewide Career Pathways system that actively engages stakeholders and features on-ramps to training and off-ramps to good jobs for workers of all educational and skill levels
- Create a statewide system of student supports that addresses academic and non-academic needs, leading to better retention, and accelerates student outcomes through a variety of proven strategies
- Connect information and communication to assist participants in making informed choices and allow for data driven analysis to inform Consortium decision-making, continuous improvement, and planning
- Employ technology to strengthen programming and delivery and increase statewide access to high-quality coursework, instruction, simulations and labs, and work-based learning opportunities
- Construct strategic partnerships that engage employers and leverage resources to create a durable network of relationships that meet the needs of employers, students, and other stakeholders over time

Methods employed to address the evaluation questions included document review, interviews, focus groups, questionnaires, and review of extant data prepared by the college. Hezel Associates assessed program implementation and associated outcomes to address the following evaluation questions:

1. How was the particular curriculum selected, used, or created?
2. How was the program managed and implemented?
3. How are CPAM colleges conducting in-depth assessments of participant's abilities, skills, and interests to select or enroll individuals into the program?
4. What strategies were used to provide career guidance for CPAM participants?
5. What contributions did each of the partners make in terms of (a) program design, (b) curriculum development, (c) recruitment, (d) training, (e) placement, (f) program management, (g) leveraging of resources, and (h) commitment to program sustainability?
6. To what extent were credit for prior learning protocols implemented?
7. To what extent did the use of new technology impact program implementation?
8. What scale-up and sustainability opportunities exist for CPAM colleges?
 - 8.1 To what extent are CPAM programs or content adaptable to other fields?
 - 8.2 What is the capacity of CPAM colleges to react to the economy and adapt to other fields?
9. What were the outcomes in terms of students' attainment of certifications, certificates, diplomas, or other recognized credentials as a result of CPAM?
10. What impact did the CPAM programs have on participants' employment outcomes?

Findings

CPAM colleges developed and improved existing technical certificates. One-year certificates prepared students to test for basic industry credentials or entry-level employment, while also accelerating them through a two-year degree. Other integral components of CPAM project included virtual platforms providing equal access to opportunities across the state, project navigators providing intrusive/wrap-around advising, improved partnerships (industry, institutional processes, and the integration of new technologies and equipment). The following sections detail findings relating to the implementation of CPAM as well as students' achievement of targeted outcomes, as an indication of student-level programmatic impact.

Implementation

- **As a result of grant activities, CPAM colleges are well positioned for the future.** Cyber security is a growing field, and CPAM colleges are well prepared to adapt to market changes due to improved lab spaces, commitments from leadership, increased collaboration among partner colleges, employer partnerships, and revised curricula.
- **Investments in infrastructure and technology allowed new programs to blossom while also revitalizing colleges with pre-existing programs.** Many programs purchased new or updated equipment, which afforded advancements like the opening of new virtual and physical labs. The NETLAB+ Academy (virtual labs) content aligns with the college's coursework, thus industry credentials by extension. The physical labs were upgraded with new, faster equipment, which allowed for the opening of additional courses. The only issues experienced surrounding the new technology were with regard to delays in purchasing, rather than in its usage or satisfaction.
- **Employer partners were influential to CPAM successes.** Programs were in frequent contact with employer partners through advisory boards and other modes of communication. Programs utilized employers' recommendations in such areas as test preparation, textbook selection, coursework development, and lab design. Employers also offered valuable feedback relating to the types of skills they seek in prospective employees. They participated in open houses, speaking sessions, workshops, and soft skill courses. Some students were required to intern as part of their coursework, many of which were later hired to full-time positions by the local employers.
- **Institutional and employer partnerships will continue post-grant.** Employers also expressed a desire to sustain relationships beyond the grant period, as these partnerships serve the goals of both parties. Due to the interactions from grant-related activities, relationships have formed between institutions, local communities and industry partners. For example, CPAM institutions will continue quarterly calls to discuss potential opportunities and lessons learned. Currently, multiple schools are drafting proposals for new grants and partnering together.
- **Curricula clearly aligned with current industry standards.** Though some schools had existing Cyber Technology programs while others were starting brand new, all partners engaged local employers regarding programmatic alignment with new technology and

industry-relevant certifications. CPAM staff worked with industry partners, such as CISCO, to train faculty and develop certification-aligned curriculum. In addition, schools used resources, such as program guides, from the National CyberWatch Center to ensure curricula aligned with widely accepted cybersecurity standards (e.g., NSA). Aligning curricula with these standards ensured that necessary criteria were met to obtain CAE2Y designation.

- **Certifications and credentials matter in the cyber security industry.** The importance of industry certifications was stressed to students, and consortium partners structured programs so that students were equipped to pass certification exams. These efforts contributed to CPAM's cyber security programs receiving positive feedback from students and employers, particularly as related to skill development, alignment to industry needs, and integration of industry certifications.
- **Soft skills matter to cyber security employers.** Consortium partners addressed soft skills at the request of their employer partners. Colleges responded by offering a multitude of services to support student soft skill development. For example, students were offered non-credit or continuing education courses to practice interviewing and soft skills with the input and participation of different industry members.
- **CPAM exposed students to employment opportunities through employer interactions.** Open houses, workshops, and facility tours provided students with the opportunity to engage with employers and assess their soft skills. Departments held these events, usually in conjunction with industry partners (e.g., government and private sector employers). Multiple students reported getting a job due to informal exposure to employers via Cyber-related events. Additionally, employers provided a host of opportunities including internships, shadowing, apprenticeship, and other work experiences.
- **Assessment techniques were tailored to each institution.** Assessment processes are unique at each school, with the exception of standard math and English placement exams for-credit programs. Progress was made toward making PLA information more accessible to students statewide. A working group from 2-year and 4-year colleges in Maryland established meetings to discuss how information about cyber programs can be better marketed on their website so students can easier access information statewide. PLA efforts during the grant show that developing statewide standards and agreements can be difficult, as differing internal processes exist at each school.
- **New articulation agreements have been established and strengthened** across high schools and 4-year colleges during the course of the grant. Most notably, some schools have dual-enrollment articulation agreements with local high schools, where students can earn college credit in their cyber security programs.
- **Students' professional development skills strengthened due to Career Navigators and greater support staff.** Navigators offered cyber security-specific guidance to

CPAM participants. Career assistance included résumé support, mock interviewing, soft skill development, internship opportunities, and career placement. Employers often contacted navigators directly with their employment needs, highlighting the importance of the navigator-employer relationship to job placement.

- **CPAM leadership and consortium partners completed or nearly completed all milestones.** While Montgomery completed a number of the strategies as the lead college, consortium partners also did well to fulfill their roles and responsibilities. However, similar to what was experienced across many TAACCCT grants, CPAM colleges were confronted with delays as a result of budget modification and approval processes. The necessary changes in Year 1 caused delays in purchasing equipment and moving forward with other milestones. Project staff completed or nearly completed all milestones outlined, including general implementation activities and all strategies listed in the work plan. Progress toward completing these milestones did however vary among the schools due to contextual factors (e.g., PALS not being compatible with many schools' systems), as the needs of each school were both unique and diverse.
- **Grant management improved as the grant progressed.** According to some staff, initiatives that were supposed to be implemented cohesively state-wide transformed into each college taking responsibility for their own program, which turned out to be manageable for some but problematic for others. Communication improved in Years 3 and 4 as changes were made to grant leadership.
- **Potential future pitfalls were identified** surrounding maintaining qualified instructors, student certification costs, security clearance requirements, and technology costs. Currently, a few schools offer vouchers for certifications, but most do not. Instead, students are required to pay for the tests themselves, often opting to postpone taking certification exams. Security clearances were also an issue because some jobs required particular classification levels and not all employers were willing to sponsor the cost of the clearance process. Finally, staff were concerned about the feasibility of sustaining the labs due to financial costs associated with maintaining and updating technology.

Outcomes

- Most students completed CPAM programming, earning credentials, certifications, and degrees. In addition to program credentials, students also attained industry-recognized certifications. The most earned industry certifications were A+, Security+, Network+, and CCNA. Other certifications like CEH, CISA, and Linux+ were also earned, but at lesser rates.
- Many students transferred onto 4-year colleges or universities. While retention or completion outcomes for these students are unknown, transfer does provide an opportunity for students to earn advanced degrees or credentials—hopefully in fields related to TAACCCT programming.

- While some CPAM students reported that their wages stayed about the same, more than 30% observed an increase in their wages. Furthermore, most feel that they now have more employment options than what was available to them prior to program enrollment. Students also feel that staff supported them in their employment search.
- A major limitation of all wage data is that it is unknown whether students worked part-time or full-time, therefore interpretations should be derived accordingly. This limitation may also contribute to what may be perceived as inconsistencies in the two accounts of wage outcomes examined (e.g., student self-report data compared with UI wage data). There are many factors to consider when thinking about why these numbers may not directly align, including hours worked, quarters worked, and inclusion criteria. Further, some students may work outside of Maryland (e.g., DC, Pennsylvania, Virginia, New Jersey, remote), thus would not be included in the UI wage data. Moreover, depending on the nature of the company (e.g., size, type), employee wages may not be reported to UI, also contributing to distortions in earnings information. Additionally, UI data were only with regard to individuals for which exit dates were known, meaning those still enrolled or who may not have taken proper steps to officially exit programs are excluded. With regard to wage comparisons between TAACCCT and non-TAACCCT students, a limitation is comparison students were from current and historic cohorts, meaning the temporal component could also influence reported UI wages. Finally, wages were reported in various formats (e.g., hourly, weekly, monthly, quarterly, annually), and could not be aggregated or manipulated to align across data due to many of the aforementioned differences that exist in participants' employment conditions. Despite minor constraints, these data illuminate the positive employment outcomes that resulted from TAACCCT programming—an impact that should be highly regarded.

Conclusions

Overall, the CPAM grant was implemented with quality with few exceptions. Most milestones were accomplished within the intended timeline. Career navigation services and employer engagement were found most critical components to achieving desired outcomes. Most importantly, findings indicate that TAACCCT participants' wages increased following their departure from the program. Most notably, all differences—pre to post—were found to be statistically significant. Further, CPAM students tended to earn higher than non-TAACCCT participants of similar programs, both prior to and after program exit.

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INTRODUCTION

In October of 2014, Montgomery College (Montgomery) received a \$15 million grant award through the United States Department of Labor (USDOL) Trade Adjustment Assistance Community College and Career Training Grant (TAACCCT) program. Montgomery's project, titled Cyber Technology Pathways Across Maryland (CPAM), comprises 14 community colleges across the state of Maryland. The CPAM project aimed to successfully implement five strategies:

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CPAM colleges developed and improved existing technical certificates. One-year certificates prepare students to test for basic industry credentials or for entry-level employment, while also accelerating them through a two-year degree. Other integral components of the CPAM project include virtual labs and internship platforms providing equal access to opportunities across the state, project navigators providing intrusive/wrap-around advising, contextualized basic education, improved prior learning assessment processes, and the integration of new technologies and equipment. Hezel Associates served as the external evaluator for the 4-year grant, assessing the implementation and outcomes of grant activities. The evaluation aimed to address the following evaluation questions:

1. How was the particular curriculum selected, used, or created?
2. How was the program managed and implemented?
3. How are CPAM colleges conducting in-depth assessments of participant's abilities, skills, and interests to select or enroll individuals into the program?
4. What strategies were used to provide career guidance for prospective and current CPAM participants?
5. What contributions did each of the partners (employers, workforce system, other training providers and educators, philanthropic organizations, and others as applicable) make in terms of (a) program design, (b) curriculum development, (c) recruitment, (d) training, (e) placement, (f) program management, (g) leveraging of resources, and (h) commitment to program sustainability?
6. To what extent were credit for prior learning protocols implemented?

7. To what extent did the use of new technology impact program implementation?
8. What scale-up and sustainability opportunities exist for CPAM colleges?
 - 8.3 To what extent are CPAM programs or content adaptable to other fields?
 - 8.4 What is the capacity of CPAM colleges to react to the economy and adapt to other fields?
9. What were the outcomes in terms of students' attainment of certifications, certificates, diplomas, or other recognized credentials as a result of CPAM?
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This final, summative report discusses the implementation of the project over the 4-year grant period, as well as the outcomes of the project. This report includes evaluation methods, findings, conclusions, and recommendations based on the final synthesis of evaluation data.

METHODS

To address the evaluation questions, Hezel Associates implemented a mixed method evaluation, utilizing a combination of qualitative and quantitative methods to develop a comprehensive understanding of the implementation and outcomes of the project. Evaluation questions pertaining to program implementation's quality and fidelity (e.g., Evaluation Questions 1 through 8) were addressed through a review of project documents, interviews with program staff and industry partners, focus groups with program participants, and a program participant questionnaire. Evaluation questions pertaining to program outcomes (e.g., Evaluation Questions 9 and 10) were addressed through quantitative analysis of a participant employment questionnaire and extant student data from the colleges. A detailed description of the data collection and analysis processes applied throughout the evaluation is included as Appendix A. Final versions of each instrument are also included in the appendices (Appendix B through G).

FINDINGS

Findings are organized by priorities outlined by DOL, with sub-themes guided by evaluation questions. Specifically, the first section presents insights regarding implementation activities, with emphasis on strengthened institutional capacity, development and implementation efforts, partner involvements, quality and fidelity of program delivery, and operational strengths and weakness. The second section focuses on participants educational and employment outcomes.

Implementation Activities

Building Institutional Capacity

The CPAM grant built the institutional capacity of Maryland's community colleges to deliver industry-relevant training in cyber security fields to offer more programs and increase future enrollment. Interinstitutional and industry Relationships, new and improved virtual and physical labs, and curricula are building capacity.

Technology Integration

CPAM integrated virtual lab opportunities through NetLabs, which allows students to access lab training remotely. Colleges also added software such as firewall systems, virtual servers

and desktops, and isolated networks. The virtual servers and desktops, coupled with NETLAB+ content, support CPAM students' ability to learn from anywhere. Specifically, NETLAB+ is a system that allows students to remotely access content and simulations, permitting students to easily attain curriculum and assessments despite location or time. The isolated networks offer students the opportunity to observe and experiment with network environments without risking any vulnerability to the school's larger IT infrastructure. This was perceived as a benefit to students, who liked NetLabs because it enabled them to autonomously explore and make mistakes without worry of completely ruining a real system.

One student even described these virtual lab experiences as "amazing." Labs equipped with newer technology received positive reviews from students. Some described the labs as "awesome" and noted they were filled with proprietary software for practice activities. While students were able to complete tasks with the older technology, they understand that the new equipment is "state of the art" and preparing them for their career.

Another way CPAM utilized technology to strengthen the program was by providing students with competency-based program offerings. Anne Arundel Community College (AACC) integrated a personally adaptive learning system (PALS) within their Cyber Technology certificate program, allowing students the ability to move through the program at their own pace. AACC supported expansion by providing training on PALS to other consortium colleges. Although not adopted consortium-wide, six schools piloted PALS for their A+ certification courses. AACC proposed multiple options to sustain the PALS system. PALS was designed to be a mandatory component for the curriculum but proved difficult for colleges to adopt due to cost or preference for other similar platforms. Some of the departments will keep utilizing the PALS system in their curriculums, and the creators of PALS would like to find the funding to expand the platform to other exams. For colleges interested in continuing PALS, they have the option of paying a hosting fee. A free version of PALS is available online from Carnegie-Mellon, which was contracted to assist with development of the platform. The free version does not offer the full suite of services available in the version that requires a hosting fee. Three schools are adopting it, including a university in Arizona. Related, Harford adapted their Information Assurance certificate into a modular, competency-based format and has launched classes in this format, but the certificate was not adopted consortium-wide.

Virtual internships were less successful than Virtual labs and PALS due to industry partners' need to view student applicants prior to enrolling. Likewise, students wanted to view potential employer partners before signing up for the website. According to staff interviews, it might have made more sense to make registering for a virtual internship part of the student intake process.

Overall, students reported that when technology was updated, they were offered richer learning opportunities. When technology was outdated, students expressed frustration, believing the equipment limited their learning experiences. Practicing on industry-relevant technology prepared students to complete vital certifications needed to be noticed by employers.

Scale-up and sustainability

CPAM colleges are well positioned for future success due to investments in improved lab space, commitments from leadership, increased communication among partner colleges, employer partnerships, and adaptable curricula curriculum. Consortium colleges are much more prepared to address market conditions compared to their readiness prior to the grant. The infusion of capital from TAACCCT was used to build and refurbish labs and equipment that will serve as the foundation for cybersecurity programs for the foreseeable future. Staff feel their equipment and instructors, as well as newly established processes, position them to adapt to market changes.

The renovated lab spaces on campuses also allow consortium partners to adequately house new equipment and technology. For example, additional servers required more space and proper storage (e.g., temperature control, racks, cabling), which was accommodated. Employers spoke highly of the cyber lab upgrades that were implemented to support new and revised curricula. Staff believe that these “state of the art” facilities will become a “legacy” at their institutions. Even though cyber security is a fast-paced field, staff are confident that the equipment in their labs are “world class.”

Consortium colleges are addressing program sustainability differently. Some programs have received commitments from leadership to sustain the full program after grant-end, including the salaries of the navigator and instructors as well as hiring of the additional adjunct faculty. Colleges are absorbing the costs of many of the programs, with commitments being made largely due to programs’ successes. Specifically, strong program enrollment at some of the institutions has contributed to leadership’s decision to sustain programs. Colleges are also seeking outside supplementary resources. Most have applied for future grants and are meeting with local organizations to ascertain whether they are willing to sponsor students financially. Staff at one school reported that they have attended grant-writing workshops in an effort to improve the quality of their proposals. Some colleges were proactive, making commitments to personnel during the grant writing process, including the cyber academic advisor and IT technician positions. These positions will be funded by colleges’ operating budget once the grant is closed.

Outside of programs and personnel, Colleges are also making considerations about sustaining particular services. At one college, the Cyber Center is planning to continue its role as being a place for students to study and improve their skills. Other colleges reported that internships and job placements would continue to be engaged, as that is core to community college practice. Once the grant is concluded, some colleges’ even desire to expand activities, providing courses at the high school and, perhaps, middle school levels. While plans are in place at some institutions, it is not clear whether others have made similar commitments or if they have begun contemplating sustainable options.

Two colleges have established articulation agreements with their county high schools, and all colleges report significant strides in improving articulation agreements with four-year universities. The CPAM statewide collaboration and TAACCCT investment in equipment and infrastructure were cited as reasons for strengthening relationships and articulation agreements where barriers were previously perceived.

Employer relationships were mentioned multiple times by staff as vital to sustain CPAM activities post-grant. More than 300 new employers were engaged during the grant period. Diverse entities ranging from small contractors to large companies and government organizations were involved in grant activities. Employer partners have expressed that they are also committed to maintaining relationships once the grant concludes. The CPAM lead, Montgomery College, is collaborating with their other DOL grants, America's Promise, and TechHire, to develop an industry leadership team to ensure collaborative work between community colleges and industry is being sustained and scaled. Staff members across campuses feel that their programs are able to adapt to market conditions due to their relationships with employers. For example, a new partnership initiative between Alleghany and IBM positions the college to adapt to the changing landscape of cyber. In this partnership, Alleghany will use IBM's tools and software (e.g., QRadar). They will also continue to develop their program, as IBM will continue to work with them on future projects (e.g., "new collar initiative"). Most CPAM colleges have their own stories of success with employer partners. The "new collar initiative" is trademarked by IBM, but its premise is gaining momentum in industry, as noted among many CPAM partner colleges, as they bridge skill gaps and workforce needs, with apprenticeships and up-to-date, industry-advised, hands-on training.

Grant activities have also led to more collaboration among partner colleges on cyber security initiatives. One crucial outgrowth was the career navigator workgroup developed among partner colleges. According to members, they were a close-knit workgroup fulfilling grant requirements surrounding building "communities of practice." However, they were above and beyond, providing a system of support for one another, and a sustainable platform to share best practices. They identified potential improvements and brought these ideas back to the consortium. For example, two of the colleges developed different and effective electronic intake processes, and they were each adopted by some of the other colleges and perceived as both helpful and effective. The increased collaboration among schools, coupled with commitments from consortium leadership to cybersecurity programs, has led to other collective projects. For example, 13 CPAM partner colleges are moving forward with an EARN grant and projects are planned around cyber security events and competitions. These communications and collaborations will sustain post-grant as CPAM members have agreed to quarterly consortium phone calls.

Most colleges feel that programs are required to quickly adapt to changes in the field. One institution even developed a slogan conveying how they want to be able to "move at the speed of business." To accomplish this goal, colleges became more intentional in developing courses that are adaptable, since the content in cyber security, and IT more generally, changes rapidly and continuously. Industry leader CompTIA is a vendor-neutral testing certification that validates students' skills aligned with industry values, so most courses and curricula have been aligned with CompTIA certification objectives. In addition to CompTIA, training aligned with other industry certification trainings are also heavily embedded in various course offerings. Most instructors hold key certifications and are highly qualified to teach to these industry-valued credentials. Many faculty members are adjunct, where they work in the field full-time. Finding full-time faculty is challenging, since cybersecurity is a lucrative field that college compensation plans struggle to straddle. The benefit of adjunct faculty is their real-

time exposure to industry trends and demands. The colleges rely on these adjunct faculty and CPAM-developed industry advisory councils to remain in tune with, and ahead of, the technology curve.

Barriers to sustainability

A potential barrier to sustainability identified is the cost of certification exams. A failing performance means having to pay the full cost again to retake the exam. Some certifications allow for vouchers (e.g., Cisco), but receipt is often dependent on course performance. In addition, there is a time limit (90 days) for retakes in some cases. Some students missed that deadline and felt it was too brief. One college reported utilizing funds from a different grant to purchase exam vouchers for students, a practice that other colleges are considering.

Funding for student tuition is a concern for non-credit programs because their students are ineligible for scholarships—another barrier to sustainability. In addition, some staff reported difficulty finding qualified instructors, which is a threat sustaining programing. Another worry surrounds maintaining technical software and equipment, as it can be costly. Many colleges are considering other funding opportunities to support technology maintenance, but most schools are absorbing those costs into operational budgets. Finally, while the grant has been helpful in terms of bringing awareness to the programs, and where most schools have experienced exponential growth, for a few schools, there is concern surrounding continued recruitment and enrollment.

Development and Implementation of Training Programs

Hezel Associates researchers accounted for the methods in which CPAM curricula were selected, used, or created by analyzing program documentation and qualitative data from staff and employer interviews, and student focus groups. Consortium partners developed program curricula similarly, gathering extensive feedback from regional employers, but also utilized unique approaches to serve their diverse regional economies.

Curriculum Development

A consistent approach to curriculum selection, use, and creation was inclusion of employer input during curriculum development. Most programs worked closely with employer advisory boards during the initial planning to assure alignment of programs with industry needs. Some of these curriculum changes consisted of alignment with industry credentials. Other updates were made to align with new software or equipment in the campuses' cyber labs.

Some of the schools used other external resources, such as program guides from the National CyberWatch Center, to ensure curricula align with widely accepted cybersecurity standards (e.g., expectations of the National Security Agency. Aligning curricula with these standards also ensures the necessary criteria are met to obtain Center of Academic Excellence 2-Year (CAE2Y) designation. Further, curriculum written for PALS was aligned with objectives outlined in the CompTIA A+ Core Certification. An example of curriculum hierarchy implemented by one of the colleges is as follows: The Associate Degree in Cyber Security is the highest credential that can be earned; the Network Technology Certificate and the Cyber Security Certificate can both progress into an associate degree; and lastly, students can opt to take only the required classes for specific certifications (e.g., A+, Security+). Staff opined that curriculum alignment with industry

credentials (e.g., CompTIA A+) prepared students to subsequently pass certification exams. Focus group participants were equally complimentary of industry-aligned curriculum, believing that the content would help prepare them for the cybersecurity workforce.

The newly developed associate degree program at one of the colleges has been designed to prepare students for many industry certification exams, namely CompTIA A+, CompTIA Network+, and CompTIA Security+. Certifications are highly valued by employers, and staff reported that recent graduates found jobs because they possessed certifications. Staff stressed that all new and revised programs prepare students for key certifications. The importance of industry certifications is often emphasized to students, by both program staff and employers. The certificate courses are structured so that students are equipped to take certification exams at the end of each respective class. Focus group participants confirmed that curricula are in line with industry expectations and relevant certifications.

Overall, the curricula developed during the CPAM grant incorporated input from a variety of perspectives, including regional industry partners as well as national industry associations and organizations. CPAM staff focused on aligning new and revised curricula to industry standards and credentials, thus strengthening students' skills related to relevant industry competencies and increasing their prospect of successful entry into the workforce.

Delivery

CPAM colleges aimed to serve different learning styles of students by designing courses that includes a mixture of readings, lectures, and hands-on activities, as well as offering online or accelerated programs. CPAM colleges were successful at developing multiple methods of delivery to suit students' needs.

The curricula developed through CPAM funds incorporate significant hands-on opportunities at the behest of regional employers, as cybersecurity is a highly technical field. In one class, students were taught how to change computer components (e.g., the computer's RAM). After that learning experience, one student thought, "Why did I pay people to do this for me before?" In general, most students prefer hands-on experiences to traditional "book work," but understand the importance of both elements to their overall learning. Every class session in each course is required to incorporate hands-on activities with equipment and technology. This was a key factor as students can only find employment if they can demonstrate experience working with equipment. This program component was the reason that many students with bachelor's and master's degrees in relevant fields enrolled in the cyber program, as they hoped to gain the necessary hands-on experience they were lacking.

Schools recognized the need for alternative modes of delivery and are moving to develop an online equivalent for many courses to better accommodate students at a distance or who might otherwise have other conflicts (e.g., scheduling, work or family obligations). A few colleges offered an accelerated class structure, with courses lasting between 7 to 10 weeks. For example, the courses at one college are heavily accelerated, where courses are delivered within a 6 to 7 week period, though a course of that workload could normally be 15 weeks long. To accommodate the accelerated program, the college utilizes a hybrid course structure, as it

affords students flexibility. Many students felt that the condensed format had great benefits. For instance, taking 7-week courses allows you to complete the program quickly and move on to a job. Clearly, an accelerated class format suited some students' needs but may not be appropriate for others. Criticisms of the accelerated format included too much content being covered in such short time, instructors not being able to go in-depth on most topics, challenges with comprehending and recalling the information, and lessened quality of educational experience.

Overall, the curricula developed during the CPAM grant will serve a diverse group of students at various stages of their careers. Some new and revised CPAM programs are non-credit, and others are credit-based. Additionally, some are certificate programs while others are associate degree programs. The majority of students truly appreciate CPAM programs. Most programs were designed to align with industry certifications, while others equip students with the skills needed to pursue relevant certifications after program completion. Finally, Colleges worked with employers to determine course alignment and delivery methods, assuring adequacy and effectiveness of approaches.

Prior learning assessment protocols

In order to determine how CPAM colleges assess participants' abilities, skills, and interests upon enrollment, Hezel Associates analyzed qualitative data from staff interviews, student focus groups, and a student questionnaire. Most colleges required new students to take a math or reading placement exam, such as the Accuplacer, to identify remediation needs. For some colleges, there were no formal assessment procedures to examine student abilities, skills, and interests prior to program enrollment, outside of general college admission processes and the CPAM intake form.

Student surveys found that participants differ in terms of age, education experience, and past careers, but most decided to enroll in the cybersecurity program due to an overall interest in computer-related fields or the desire to expand their computer-oriented skillsets. Student goals differ as well. Students seek various levels of achievement, including industry certifications to find immediate employment, graduating with an associate degree, and transferring to a four-year degree program to earn a bachelor's degree.

Although a standardized Prior Learning Assessment (PLA) process is not in place across the consortium, individual colleges have developed strategies to assess skills. At one college, students meet with the navigator to learn about the program and to assure program objectives align with their interests. Students cannot enter the program without partaking in this process. For one college, a newly implemented skills assessment is optional for students once they are in the program. Four self-assessment modules were developed for this system. The navigator examines results to measure student needs. Essentially, the assessment is utilized to identify how students can be further assisted, using student goals as a benchmark. Results are also used in the Cyber Center to bridge the gap between students' technical competencies and the proficiencies needed to reach academic and career goals. These assessments are unique to this institution.

At the statewide level progress was made toward making PLA information more accessible to students. A working group from 2-year and 4-year colleges in Maryland has been meeting to include information about cyber programs in a website for students to access across the state. Per staff interviews, PLA opportunities are prevalent in cybersecurity, as students will be able to receive credit for certifications, prior work experience, and successful completion of advanced courses. Examples of industry certifications potentially eligible for prior learning credit include: CompTIA A+, Net+, Security+, Linux+, Microsoft Certified Professional, and CISCO.

Career guidance and support

To understand the strategies used by CPAM colleges to provide career guidance for prospective and current CPAM participants, the focus of Evaluation Question 4, Hezel Associates analyzed qualitative data collected during staff and employer interviews, student focus groups, and the student questionnaire. A major strategy of CPAM was to provide students with extensive career advising and readiness support. The exact nature and structure of career services varied depending on the college, but common to most were career navigators, soft skills development, and employer connections.

Career-readiness support was a central part of the CPAM project, identified in the gap analysis as part of the project proposal. All CPAM students had access to the general career advising or counseling available to all students. Most colleges provided a person(s) whose role is to provide career guidance for students. Though titles varied across institutions, they were generally referred to as Career Navigators. Examples of other titles include job specialist, internship specialist, cybersecurity advisor, and outreach specialist. Unlike traditional advising practices, such as a college-wide career center that assists all students with job placement, the navigator's expertise is specific to cybersecurity (CPAM students). Career Navigators had varied roles across schools, some of which included employer partner outreach to establish advisory boards and collect feedback; establishment of internship opportunities; identification and cataloging of job prospects; and counseling of students on career preparation, pathways, and planning. Navigators developed relationships with students and with local employers, benefitting both, since students and opportunities can be strategically matched.

While technical skills are always key to finding jobs, CPAM industry partners identified soft skills deficiencies as an area of concern and an integral component of employability. Colleges responded by implementing strategies that aided soft skill development. Targeted activities engaged included hosting workshops and other events focused on resume building, mock interviewing, writing, delivering speeches, developing presentations, and LinkedIn etiquette. Some colleges directly involved employers to add an element of authenticity. Moreover, technical writing and speech courses were developed to address observed gaps in employees' verbal and written communication skills.

Industry partners participated in a multitude of events to expose students to interaction with employers. Successful strategies noted by staff include on-campus interviews, where multiple companies are invited to interview students on campus, and Cyber Hangouts hosted throughout the semester, where students engage in hands-on activities. Cyber competitions, open houses,

workshops, and facility tours provided students with the opportunity to engage with employers and test their technical and soft skills, and were usually sponsored by the colleges in conjunction with industry partners (e.g., government and private sector employers). Multiple students reported finding employment due to informal exposure to employers via Cyber-related events.

Problems encountered as students were preparing for employment included certification costs and security clearance issues. Both were obstacles encountered by students at many of the colleges. The program does not pay for certification tests; however, there are opportunities at some of the colleges for discounts or reimbursements. For instance, one campus has a voucher that students can use to get a 50 percent discount. There are also alternative grant programs that reimburse students for certification exam fees if they pass the tests. Security clearances were also an issue because some jobs required security clearances and not all employers were willing to sponsor the cost of the security clearance process, although some students were sponsored, leading to higher-paying jobs according to staff.

Overall, students were highly satisfied with the career guidance offered. CPAM colleges, with few exceptions, provided students with ample opportunities to receive support from career navigators with résumés, mock interviews, soft skills, internship, and career placement. College staff, students, and employers understand the importance of certifications to potential employers, and work to prepare and support students to pass important tests.

Partnerships

One of CPAM's major strategies was to construct strategic partnerships with employers and other stakeholders. Hezel Associates researchers accounted for contributions from partners through analysis of qualitative data collected through staff and employer interviews, student focus groups, and program document review. The primary partners contributing across CPAM colleges are employers. The resources provided through grant funds allowed CPAM staff to conduct outreach to build new networks with employer partners and other relevant stakeholders.

Employers

The primary partners contributing across CPAM colleges are employers. The quality and depth of employer relationships with colleges vary among institutions. Employers' most crucial contribution occurred during the curriculum development process and job and internship placement. CPAM colleges met with employers through individual outreach, group meetings, and advisory boards. Employer and industry feedback was used to ensure colleges are aligning curricula and Cyber Technology programs to industry needs. Employer feedback also helped college staff and faculty make decisions regarding which types of software, hardware, or certifications would best help their students succeed in finding employment.

In addition to program and curricula design, employer partners contributed to internships and mentoring. Employers participated in job fairs and mock interviews, served as guest speakers at events, and provided tours of facilities. Members of advisory boards became adjunct professors at some schools, strengthening the ties between industry and the colleges. Some colleges hosted cyber awareness events, where members of the advisory board delivered presentations. Further,

most of the colleges had employers who provided internship experiences for students. One employer who hired two interns noted:

“I was frankly very impressed. As far as the interviews themselves, they went very well, they were obviously trained in how to conduct themselves in an interview and the number one thing I think both of them share in common is just they have, they followed through very well, they want to learn more and more and they are very, very engaged in the office workspace. As far as skill level, they’re entry level, but (anonymous) in particular really pick stuff up very quickly. They already knew how to do a lot of the tools that we wanted.”

Institutional

Due to the CPAM grant, consortium colleges worked to establish new partnerships and agreements with regional entities. New articulation agreements with both high schools and 4-year colleges have been established and strengthened during the course of the grant. Many schools established or improved articulation agreements with four-year schools, alleviating some of the pressure for employment at more rural schools where job opportunities are less prevalent.

Community colleges are collaborating more frequently regarding cybersecurity programming and seeking new opportunities together. The CPAM collective intends to continue quarterly calls to discuss new opportunities and share best practices. Currently, multiple schools are drafting proposals for new grants with intentions on partnering together. Thirteen partner colleges are on a participating in an EARN grant at the Baltimore Cyber Range, where students and faculty alike get intensive, hands-on, simulation training. A statewide committee on PLA includes multiple members of the CPAM consortium as they seek to make the PLA requirements for Cyber programs in Maryland, including at 4-year colleges, and information about articulation agreements publicly available online. Some schools have dual-enrollment articulation agreements with local high schools, where students can earn college credits in their high school programs.

Community

Many of the consortium colleges conducted community outreach on behalf of the program to support enrollment. Program staff engaged businesses, veterans, high schools, and other community members to inform them about the programs. For example, some colleges advertised on the radio and at local community organizations. Others recruited students from local high schools. One school hosted an annual Cyber Day, inviting local high school seniors. There were reports of students registering for the program on the spot. Furthermore, many of the colleges’ outreach plans included digital marketing and program advertisements on their websites. The SANS institute brought in most colleges to participate in recruiting events, where students learned things, and demonstrated skills, related to cybersecurity by competing in challenges.

CPAM staff partnered with Workforce Investment Boards (WIBs) to assist them in marketing the program. One potential barrier to enrolling students in a one-year certificate or two-year degree in Cyber Technology is the belief that to get a job in the cybersecurity field, individuals must have a bachelor’s degree. CPAM colleges are working with their WIBs to reduce that

stigma by informing students and industry of the unique training CPAM programs provide. In addition to marketing, WIBs are contributing through more traditional recruitment, as well, sharing information and resources to individuals seeking training or employment. At one college, the institutional internship program works with the local OneStop to identify opportunities for students. According to staff interviews, the relationship with WIBs can be different based on contextual factors at each school (e.g., location, previous working relationship).

Some programs engaged their community and employer partners in curricula delivery. For example, curricula delivery for Baltimore County Community College (BCCC) was based on “community and people.” The training coordinator hired subject matter experts, curricula developers, and instructors, but also prioritized building relationships with both IT companies and community organizations. BCCC staff felt that it was important to address the needs of both industry and the community.

Implementation Quality and Fidelity

Program management and implementation were assessed through analysis of program documentation and qualitative data from staff and employer interviews as well as student focus groups. This data provided evidence that CPAM colleges met most of the milestones listed in the project work plan and mostly on the intended timeline. Montgomery, managed by the CPAM Project Director, directly contributed to many of the activities and strategies for the project. In addition, partner colleges were successful in meeting many of the milestones applicable to their varied roles and responsibilities.

The CPAM Project Director oversaw the project at the consortium-level while the other 13 colleges established internal teams to implement the project at the college-level. Partner colleges utilized program managers and coordinators, career navigators, faculty, and other administrative staff to implement CPAM with fidelity and quality. Most of the staff hired for these positions were new to their respective colleges, or to the CPAM project specifically.

In terms of grant management, initially the CPAM consortium had mixed feelings about the support and communication provided by Montgomery. However, communication improved in the Years 3 and 4. Colleges experienced delays receiving responses to emails requesting guidance about counting participants. While some schools were happy with the communication and the processes established, select schools indicated they would have liked to see faster turnaround on responses and feedback on questions. Some of the reported problems were related to frequent changes in forms and requests for reports not included in the original protocol, much of which occurred on short notice. Some schools were unable to purchase required equipment and other resources because they were waiting for budget approvals from DOL. Many expressed frustrations at the turn-around time for budget approvals and felt that communication about the approval process was sparse. Overall, communication issues in Years 1 and 2 may have slowed quality implementation of the grant. However, there was a change in CPAM grant management in Year 3, as an Interim Project Director replaced the former Project Director. Eventually the Data Manager advanced to the Project Director position, which had additional support from the Interim Project Director for the remaining grant period.

Strategy 1

Build an easily navigable statewide Career Pathways system that actively engages stakeholders and features on-ramps to training and off-ramps to good jobs for workers of all educational and skill levels.

Mostly completed by the proposed dates, consortium member schools achieved the milestones outlined for the four activities of Strategy 1. Carroll Community College was responsible for developing a new contextualized GED program over the course of the grant, using the Maryland Integrated Basic Education and Skills Training (MI-BEST) model. Carroll Community College piloted an IT Fundamentals program, but did not need to include a GED preparation component, as all participants had completed their high school degree or equivalent. The team at Carroll decided not to continue the program because they did not see the need moving forward. For Activity 1.2, the work plan stipulates that the consortium member schools adapt the Cyber Technology Certificate. Although colleges did not adapt the certificate, all colleges now have some type of cybersecurity credential aligned with standards of the CAE2Y designation. Therefore, all participating schools will have the CAE2Y designation.

To satisfy the third and fourth activities of this strategy, several schools convened with employers to survey their needs and ensure curriculum alignment with industry. New curricula developed with industry input included courses focused on cloud computing, research integration, security clearance, and background checks. Multiple schools initially developed one or more non-credit courses and then initiated the curriculum committee process to gain approval for those to be offered as a credit-bearing course. The curriculum approval process could be lengthy at some colleges. In some cases, approval started with an internal committee, before being sent to Maryland State Department of Education for final approval. The approval process could take up to six months, or even longer. This was especially true for courses that were offered for credit.

Strategy 2

Create a statewide system of student supports that addresses academic and non-academic needs, leading to better retention, and accelerates student outcomes through a variety of proven strategies.

Strategy 2 focused on student supports and comprised five main activities for project staff. First, by the close of Year 1, the consortium member schools were expected to submit for approval a statewide system for prior learning assessment (PLA). The consortium lead school started the procurement process for a PLA system by writing an RFP in December 2014. According to discussions with staff, there was no uniform PLA policy across Maryland Community Colleges, but some PLA credits was awarded to students. Each college had their own process for assessing students' abilities. Students across multiple colleges reported they were able to transfer in credits from past college experiences. Some of the general education courses students were able to transfer in included math, science, history, psychology, and sociology, to name a few. One student was even able to get credit for an introduction to computer course he took in 1994. As

described previously, a facilitated statewide faculty articulation committee, including 2-year and 4-year schools, gets together once a year. The group developed a site to post cybersecurity programs in Maryland. After connecting with stakeholders from the TAACCCT grant, they also included a section of the website on PLA. The site identifies all programs and credentials, and transfer and articulation agreements for participating colleges, which currently includes 14 colleges. The participating colleges are approaching one school at a time on the agreement and developing processes to maintain the site due to frequently changing requirements.

The cyber bridge milestone was removed from the work plan. The remaining three activities were completed by the close of the project. For example, partner colleges provided one-on-one career guidance to CPAM students, but it may be structured differently depending on the institution. Career navigators scheduled meetings with students after entering a program to communicate what is expected and what the field requires. At one institution, the navigator met with students face-to-face at least once per week; served as an advisor for a student chapter of the Information Systems Security Association and met with student club members monthly; sends out job, internship, apprenticeship, and volunteer opportunities every Friday; and gathers and disseminates information regarding regional jobs and other relevant opportunities from various websites.

Strategy 3

Connect information and communication to assist participants in making informed choices and allow for data driven analysis to inform Consortium decision-making, continuous improvement, and planning.

The priority of Strategy 3 was to use program data to assist participants in making informed choices and to inform the consortium in decision making, continuous improvement, and planning. Montgomery collected initial data as well as quarterly reports from partner colleges. In addition, Montgomery contracted the Jacob France Institute at the University of Baltimore to collect wage data for participant outcomes and create a database specifically designed for CPAM data collection and organization. Montgomery initiated a forum for collaborative discussions amongst partner colleges in the form of weekly meetings held with Montgomery via teleconference. Staff reported mixed reviews about the meetings, but many consortium partners found them to be effective and helpful.

The consortium utilized Basecamp initially, an online project management application used to share documents and resources as well as support discussion among CPAM partners. Based on CPAM staff experiences and opinions, this was not the ideal tool for the consortium. CPAM staff indicated that the information on Basecamp did not provide enough clarity on questions and consisted mainly of USDOL documents and resources as opposed to information specific to CPAM. Staff suggested additional information, such as meeting minutes and agendas, internal policies, answers to frequently asked questions, or project goals would have been useful. In the final years of the grant, consortium colleges shared program documents, including performance reports, via Dropbox. Templates were created by Montgomery to standardize the data collection process.

Strategy 4

Employ technology to strengthen programming and delivery and increase statewide access to high-quality coursework, instruction, simulations and labs, and work-based learning opportunities.

Incorporation of technology to strengthen programming and delivery and access was the focus of Strategy 4 of the work plan. For the first two activities of Strategy 4, schools expected to launch virtual labs and internship platforms mostly completed this task by Year 2. The other two activities for Strategy 4 were completed by the end of Year 2. However, it was noted that Harford Community College is the only school adapting the Assurance Certificate into a competency-based format (Activity 4.3).

AACC developed a PALS platform for the Cyber Technology Certificate for other schools to incorporate (Activity 4.4). PALS operates as an open source platform available to anyone who creates an account. Training was provided by AACC to introduce colleges to the new system. Montgomery College brought together all consortium colleges for training on PALS, in a face-to-face, hands-on workshop. A roadblock prohibiting many colleges from attempting to use this technology is the existing systems their institutions have already purchased and implemented. Structurally, the integration of both systems would prove to be difficult due to issues of compatibility.

The only issues with the new technology were delays in purchasing, rather than in usage. There seems to be a positive response to the new technology and equipment incorporated. Some of the partner colleges needed these upgrades and CPAM gave them the opportunity to provide high quality tools and resources for Cyber Technology students. Other than budget approval delays in implementation, new technology and equipment have been beneficial for faculty and students. Colleges purchased other technological supplies, which differs from equipment (equipment is defined as having a minimum cost of \$5,000), including laptops, monitors, Cisco equipment, servers, other hardware, and software. Institutions that did not build new labs report that buying smaller pieces of technology and updating the lab spaces helped to invigorate their pre-existing labs. This was particularly beneficial, as it “raised the image of the program.” Students felt that Net Academy, the Cisco web-based learning tool, worked well. Although, there was a lag in the system during the initial roll out, those issues have since been worked out.

Strategy 5

Construct strategic partnerships that engage employers and leverage resources to create a durable network of relationships that meet the needs of employers, students, and other stakeholders over time.

Strategy 5 focused on the construction of strategic partnerships with employers to create a durable network of relationships that meet the needs of stakeholders over time. A Review of program documentation suggests all of the schools developing curricula utilized local employers during the process to align curricula with industry needs. Meetings included discussions of what to incorporate in new curricula being developed, in addition to feedback on existing curricula. Documentation showed that schools convened advisory committees to gather input for the

programs in other ways. For example, an advisory committee informed one institution that students were lacking necessary soft skills, resulting in the creation of a Cyber Literacy Institute. Some colleges also solicit feedback from regional technology councils, having more than 200 affiliate companies.

Staff report that employers are crucial to programs' success. Career Navigators communicated with employers each day at most schools, introduced themselves to new employers, and made sure to keep tabs on which companies received large grants. At one of the colleges, students visited a major area corporation. While reflecting on that real-world experience, a student shared that he was able to better understand concepts and processes explained in the book that he had not fully conceptualized prior to the visit. Employer partners offer internship opportunities for students, which are often paid. Overall, employer engagement has been a great success of the grant and will lead to future successes for partner colleges.

Participant Outcomes and Program Impacts

Core Targeted Programmatic Impacts and Outcomes

The CPAM program aimed to realize key outcomes relating to credential attainment and employment. The following sections detail students' achievement of these targeted outcomes, serving as an indication of student-level programmatic impact.

Credential attainment

Multiple data sources were used to assess participants' credential attainment, including the Employment Questionnaire and extant data from the CPAM G*Stars system and Student Clearinghouse. Findings derived from each source are presented below.

*G*Stars and Student Clearinghouse Data*

According to G*Stars data, on average, students were about 27.8 years of age ($SD = 11.13$) at intake, with 74% of students identifying as male and 24% as female. About 47.4% of students were enrolled in a TAACCT program full time, 38.8% part-time, and 13.8% in a non-credit program. Further, an indicator that was not a targeted outcome, but still of great significance, is students' continuation along academic pathways. Student clearinghouse data indicate that about 420 TAACCCT students transferred to another institution of higher education, with 380 of those being 4-year colleges or universities. While retention or completion outcomes for these students are unknown, transfer does provide an opportunity for students to earn advanced degrees or credentials—hopefully in fields related to TAACCCT programming.

Employment Questionnaire Data

Based on data obtained via the Employment Questionnaire, of the 800 participant respondents, 54% completed their program of study, earning a credential, certificate, or associate degree; 14.6% withdrew prior to earning a credential; and 31.4% are still currently enrolled (see Table 2 of Appendix H). Further, of total reported credentials earned ($n = 422$), 56% were a 2-year degree, 31% non-credit certificates, and 17% credit certificates (please note that respondents were allowed to report more than one earned credential; see Table 4 of Appendix H). In addition to program credentials, students also reported attaining industry-recognized certifications. Of

those that earned industry certification (n = 309), most were for A+ (49.8%), Security+ (38.5%), Network+ (34.4%), and CCNA (12%). CEH, CISA, and Linux+ certifications were also earned, but at much less rates (between 0.65% and 3.2%). Finally, nearly 18% of respondents also documented earning other types of certifications, including Cyber Ops, ITIL, PMP, CAHIMS, Cloud Essentials, GX Security Essentials, Certified Help Desk, Certified Engineer, Cyber Security, CISCO, MCSA, Test out, Cloud+, CCENT, Ethical Hacker, NetPro, Certified Data Recovery, CCNP Routing, OSCP, CompTIA, Java Bootcamp, GSEC, GCIH, SPLUNK, and MTA (see Table 5 of Appendix H).

Employment outcomes

According to data obtained from the CPAM G*Stars system, at the time of program enrollment, about 55.9% of participants identified as incumbent workers (n = 2,256). Further, 42.5% of TAACCCT participants reported being underemployed at in-take. Underemployment within this context could include low wages, job not being commensurate with skills or education, or part-time work status. Examination of the data sources outlined below provided insight into subsequent employment outcomes.

Employment Questionnaire Data

Based on data obtained via the Employment Questionnaire, 71.6% of respondents are currently employed (n = 557), though the industry of employment is unknown. Respondents were asked to identify how they were paid their wages (e.g., annual salary, hourly wage, weekly wage, or monthly wage). Of those that were employed and provided wage information, most reported being paid hourly (61.3%) followed by being compensated on an annual salary basis (34.8%). The average reported annual salary was \$58,233.80 (SD = \$28,848.12), with a median salary of \$55,000. Salaries ranged widely, extending from \$5,750 to \$180,000, annually. Further, the average hourly wage was \$17.36 (SD = \$9.32). The median hourly wage was about \$15.00, with hourly wages topping as high as \$97.50. Approximate weekly and monthly wages were \$304.54 (SD = \$364.41) and \$2333.29 (SD = \$2248.96), respectively.

Most respondents report that their wages stayed about the same (61.7%), though more than 30% observed an increase in their wages. Furthermore, more than half of respondents feel they now have more employment options than what was available to them prior to program enrollment. Interestingly, 25% are unsure about how their employment options might have changed. Overall, regardless of employment options or wage changes, 34% of respondents say that college staff supported them in finding employment.

Maryland Unemployment Insurance Wage Data

A CPAM program partner, Jacob France Institute, also provided evaluators with quarterly unemployment insurance (UI) wage data for the State of Maryland, which offers additional insights into employment outcomes. Examining four quarters prior to program exit, on average, TAACCCT students (n = 851) earned \$5,942 per quarter. In contrast, four quarters following program exit, on average, TAACCCT students (n = 714) earned \$6,962. These figures represent students who were employed at any time during that pre- or post-exit period, respectively, with mean earnings encompassing only quarters for which wages were reported (e.g., income of \$0 was excluded from averages). While it appears that less students may have been employed post-

exit, average quarterly earnings did increase. In fact, comparing relatively associated pre- and post-quarterly wages (e.g., one quarters prior to program exit compared with one quarters after, two quarters prior to program exit compared with two quarters after, and so forth), participants' post wages were higher across all quarters. Please see Table 1 below, which displays quarterly wage trends pre- and post-exit.

Table 1. Quarterly Wages Trends

	Pre-Program Exit						Post-Program Exit					
	n	M	SD	Min	Max	Median	n	M	SD	Min	Max	Median
Q 1	727	6462.53	5745.65	2.00	37752.00	4683.00	634	6972.96	5850.58	9.00	38846.00	5505.50
Q 2	723	6186.99	5570.01	21.00	38800.00	4691.00	546	7603.21	5985.81	54.00	40521.00	6519.50
Q 3	715	6499.13	6187.46	5.00	62480.00	4777.00	437	7682.47	5937.76	26.00	32840.00	6639.00
Q 4	723	6419.12	6142.45	3.00	56826.00	4545.00	298	8077.98	5656.66	106.00	33511.00	7373.50
4Q Avg ^a	851	5942.25	5580.59	9.00	44643.00	4259.00	714	6961.99	5689.91	9.00	39441.50	5802.38
4Q Sum ^b	851	21691.37	21530.42	9.00	169070.00	14811.00	714	20079.40	18774.55	9.00	129232.00	14579.50

a: Average of non-zero wages across the four quarters

b: The sum of wages across the four quarters

Evaluators performed a paired samples *t*-test to examine average quarterly wages pre- and post-program exit, which included participants for which earnings were reported in at least one of the four quarters prior to *and* after their program exit. Participants' (n = 629) average pre-exit quarterly earnings were \$6,424 while their average post-exit quarterly wage amounted about \$7,309. This means, on average, students made about \$884 *less* per quarter prior to program exit. Overall, TAACCCT participants' wages increased following their departure from the program. Most notably, all differences—pre to post—were found to be statistically significant (see Table 2 below).

Table 2. Paired Samples *t*-Tests of Pre and Post Quarterly Wages

	n	M	SD	t	df	Sig
Pre Q1 – Post Q1	634	-448.27	3096.37	-3.401	551	.001
Pre Q2 – Post Q2	546	-1300.71	3894.01	-7.078	448	.000
Pre Q3 – Post Q3	437	-1646.44	5198.92	-5.683	321	.000
Pre Q4 – Post Q4	298	-1738.42	4373.31	-5.949	223	.000
Pre 4Q Avg – Post 4Q Avg	714	-884.30	3683.90	-6.020	628	.000

Unemployment Insurance data were also available for comparison students. Interestingly, CPAM students tended to earn higher than non-TAACCCT participants of similar programs both prior to and after program exit (with the exception of two quarters prior to exit). While wages were higher for TAACCCT students, differences were not found to be statistically significant, but of course could be understood as having great practical significance when thinking about individuals' wage outcomes. A table comparing average wages of CPAM and comparison students is provided in the Table 3 below.

Table 3. Comparison of Quarterly Wage Trends

	TAACCT Students						Comparison Students					
	n	M	SD	Min	Max	Median	n	M	SD	Min	Max	Median
Pre-Exit Q1	727	6462.53	5745.65	2.00	37752.00	4683.00	540	6294.44	6119.05	1.00	38102.00	4432.50
Pre-Exit Q2	723	6186.99	5570.01	21.00	38800.00	4691.00	530	6441.58	6793.99	10.00	73124.00	4579.50
Pre-Exit Q3	715	6499.13	6187.46	5.00	62480.00	4777.00	535	6162.98	6184.00	10.00	41428.00	4363.00
Pre-Exit Q4	723	6419.12	6142.45	3.00	56826.00	4545.00	530	5920.36	5787.62	36.00	37506.00	4245.50
Pre-Exit 4Q Avg	851	5942.25	5580.59	9.00	44643.00	4259.00	648	5617.66	5810.72	1.00	38787.25	3841.88
Pre-Exit P4Q Sum	851	21691.37	21530.42	9.00	169070.00	14811.00	648	20444.48	23112.64	1.00	155149.00	12818.50
Post-Exit Q1	634	6972.96	5850.58	9.00	38846.00	5505.50	542	6804.43	6551.54	25.00	48639.00	4893.50
Post-Exit Q2	546	7603.21	5985.81	54.00	40521.00	6519.50	512	7247.47	6826.04	11.00	63146.00	5266.00
Post-Exit Q3	437	7682.47	5937.76	26.00	32840.00	6639.00	492	7398.01	6588.53	20.00	55031.00	5658.50
Post-Exit Q4	298	8077.98	5656.66	106.00	33511.00	7373.50	459	7768.45	6835.63	40.00	53515.00	6327.00
Post-Exit 4Q Avg	714	6961.99	5689.91	9.00	39441.50	5802.38	623	6650.48	6299.55	28.00	53498.25	4754.75
Post-Exit P4Q Sum	714	20079.40	18774.55	9.00	129232.00	14579.50	623	23441.82	24763.96	28.00	213993.00	15695.00

Limitations to Interpretations

A major limitation of all wage data is that it is unknown whether students worked part-time or full-time, therefore interpretations should be derived accordingly. This limitation may also contribute to what may be perceived as inconsistencies in the two accounts of wage outcomes examined (e.g., student self-report data compared with UI wage data). There are many factors to consider when thinking about why these numbers may not directly align, including hours worked, quarters worked, and inclusion criteria. Further, some students may work outside of Maryland (e.g., DC, Pennsylvania, Virginia, New Jersey, remote), thus would not be included in the UI wage data. Moreover, depending on the nature of the company (e.g., size, type), employee wages may not be reported to UI, also contributing to distortions in earnings information. Additionally, UI data were only with regard to individuals for which exit dates were known, meaning those still enrolled or who may not have taken proper steps to officially exit programs are excluded. With regard to wage comparisons between TAACCCT and non-TAACCCT students, a limitation is comparison students were from current and historic cohorts, meaning the temporal component could also influence reported UI wages. Finally, wages were reported in various formats (e.g., hourly, weekly, monthly, quarterly, annually), and could not be aggregated or manipulated to align across data due to many of the aforementioned differences that exist in participants' employment conditions. Despite minor constraints, these data illuminate the positive employment outcomes that resulted from TAACCCT programming—an impact that should be highly regarded.

CONCLUSIONS

Overall, the CPAM grant team and consortium partners built and revised programs that met the needs of the associated industries and followed national standards. Evaluators have devised the following final conclusions regarding program implementation and targeted outcomes:

Implementation

- **As a result of grant activities, CPAM colleges are positioned well for the future.** Cyber security is a growing field, and CPAM colleges are well prepared to adapt to market changes due to improved lab spaces, commitments from leadership, increased collaboration among partner colleges, employer partnerships, and revised curricula.
- **Investments in infrastructure and technology allowed new programs to blossom while also revitalizing colleges with pre-existing programs.** Many programs purchased new or updated equipment, which afforded advancements like the opening of new virtual and physical labs. The NETLAB+ Academy (virtual labs) content aligns with the college's coursework, thus industry credentials by extension. The physical labs were upgraded with new, faster equipment, which allowed for the opening of additional courses. The only issues experienced surrounding the new technology were with regard to delays in purchasing, rather than in its usage or satisfaction.
- **Employer partners were influential to CPAM successes.** Programs were in frequent contact with employer partners through advisory boards and other modes of communication. Programs utilized employers' recommendations in such areas as test preparation, textbook selection, coursework development, and lab design. Employers also offered valuable feedback relating to the types of skills they seek in prospective employees. They participated in open houses, speaking sessions, workshops, and soft skill courses. Some students were required to intern as part of their coursework, many of which were later hired to full-time positions by the local employers.
- **Institutional and employer partnerships will continue post-grant.** Employers also expressed a desire to sustain relationships beyond the grant period, as these partnerships serve the goals of both parties. Due to the interactions from grant-related activities, relationships have formed between institutions, local communities and industry partners. For example, CPAM institutions will continue quarterly calls to discuss potential opportunities and lessons learned. Currently, multiple schools are drafting proposals for new grants and partnering together.
- **Curricula are aligned with current industry standards.** Though some schools had existing Cyber Technology programs while others were starting brand new, all partners engaged local employers regarding programmatic alignment with new technology and industry-relevant certifications. CPAM staff worked with industry partners, such as CISCO, to train faculty and develop certification-aligned curriculum. In addition, schools used resources, such as program guides, from the National CyberWatch Center to ensure curricula aligned with widely accepted cybersecurity standards (e.g., NSA). Aligning

curricula with these standards ensured that necessary criteria were met to obtain CAE2Y designation.

- **Certifications and credentials matter in the cyber security industry.** The importance of industry certifications was stressed to students, and consortium partners structured programs so that students were equipped to pass certification exams. These efforts contributed to CPAM's cyber security programs receiving positive feedback from students and employers, particularly as related to skill development, alignment to industry needs, and integration of industry certifications.
- **Soft skills matter to cyber security employers.** Consortium partners addressed soft skills at the request of their employer partners. Colleges responded by offering a multitude of services to support student soft skill development. For example, students were offered non-credit or continuing education courses to practice interviewing and soft skills with the input and participation of different industry members.
- **CPAM exposed students to employment opportunities through employer interactions.** Open houses, workshops, and facility tours provided students with the opportunity to engage with employers and assess their soft skills. These events were held by the departments, usually in conjunction with industry partners (e.g., government and private sector employers). Multiple students reported getting a job due to informal exposure to employers via Cyber-related events. Additionally, employers provided a host of opportunities including internships, shadowing, apprenticeship, and other work experiences.
- **Assessment techniques were tailored by institution.** Assessment processes are unique at each school, with the exception of standard math and English placement exams for-credit programs. Progress was made toward making PLA information more accessible to students statewide. A working group from 2-year and 4-year colleges in Maryland established meetings to discuss how information about cyber programs can be better marketed on their website so students can easier access information statewide. PLA efforts during the grant show that developing statewide standards and agreements can be difficult, as differing internal processes exist at each school.
- **New articulation agreements have been established and strengthened** across high schools and 4-year colleges during the course of the grant. Most notably, some schools have dual-enrollment articulation agreements with local high schools, where students can earn college credit in their cyber security programs.
- **Students' professional development skills strengthened due to Career Navigators and greater support staff.** Navigators offered cyber security-specific guidance to CPAM participants. Career assistance included résumé support, mock interviewing, soft skill development, internship opportunities, and career placement. Employers often contacted navigators directly with their employment needs, highlighting the importance of the navigator-employer relationship to job placement.

- **CPAM leadership and consortium partners completed or nearly completed all milestones.** While Montgomery completed a number of the strategies as the lead college, consortium partners also did well to fulfill their roles and responsibilities. However, similar to what was experienced across many TAACCCT grants, CPAM colleges were confronted with delays as a result of budget modification and approval processes. The necessary changes in Year 1 caused delays in purchasing equipment and moving forward with other milestones. Project staff completed or nearly completed all milestones outlined, including general implementation activities and all strategies listed in the work plan. Progress toward completing these milestones did however vary among the schools due to contextual factors (e.g., PALS not being compatible with many schools' systems), as the needs of each school were both unique and diverse.
- **Grant management improved as the grant progressed.** According to some staff, initiatives that were supposed to be implemented cohesively state-wide transformed into each college taking responsibility for their own program, which turned out to be manageable for some but problematic for others. Communication improved in Years 3 and 4 as changes were made to grant leadership.
- **Potential future pitfalls were identified** surrounding maintaining qualified instructors, student certification costs, security clearance requirements, and technology costs. Currently, a few schools offer vouchers for certifications, but most do not. Instead, students are required to pay for the tests themselves, often opting to postpone taking certification exams. Security clearances were also an issue because some jobs required particular classification levels and not all employers were willing to sponsor the cost of the clearance process. Finally, staff are concerned about the feasibility of sustaining the labs due to financial costs associated with maintaining and updating technology.

Outcomes

- Most students completed CPAM programming, earning credentials, certifications, and degrees. In addition to program credentials, students also attained industry-recognized certifications. The most earned industry certifications were A+, Security+, Network+, and CCNA. Other certifications like CEH, CISA, and Linux+ were also earned, but at lesser rates.
- Many students transferred onto 4-year colleges or universities. While retention or completion outcomes for these students are unknown, transfer does provide an opportunity for students to earn advanced degrees or credentials—hopefully in fields related to TAACCCT programming.
- While some CPAM students reported that their wages stayed about the same, more than 30% observed an increase in their wages. Furthermore, most feel that they now have more employment options than what was available to them prior to program enrollment. Students also feel that staff supported them in their employment search.

- A major limitation of all wage data is that it is unknown whether students worked part-time or full-time, therefore interpretations should be derived accordingly. This limitation may also contribute to what may be perceived as inconsistencies in the two accounts of wage outcomes examined (e.g., student self-report data compared with UI wage data). There are many factors to consider when thinking about why these numbers may not directly align, including hours worked, quarters worked, and inclusion criteria. Further, some students may work outside of Maryland (e.g., DC, Pennsylvania, Virginia, New Jersey, remote), thus would not be included in the UI wage data. Moreover, depending on the nature of the company (e.g., size, type), employee wages may not be reported to UI, also contributing to distortions in earnings information. Additionally, UI data were only with regard to individuals for which exit dates were known, meaning those still enrolled or who may not have taken proper steps to officially exit programs are excluded. With regard to wage comparisons between TAACCCT and non-TAACCCT students, a limitation is comparison students were from current and historic cohorts, meaning the temporal component could also influence reported UI wages. Finally, wages were reported in various formats (e.g., hourly, weekly, monthly, quarterly, annually), and could not be aggregated or manipulated to align across data due to many of the aforementioned differences that exist in participants' employment conditions. Despite minor constraints, these data illuminate the positive employment outcomes that resulted from TAACCCT programming—an impact that should be highly regarded.

Overall, the CPAM grant was implemented with quality with few exceptions. Most milestones were accomplished within the intended timeline. Career navigation services and employer engagement were found most critical components to achieving desired outcomes. Most importantly, findings indicate that TAACCCT participants' wages increased following their departure from the program. Most notably, all differences—pre to post—were found to be statistically significant. Further, CPAM students tended to earn higher than non-TAACCCT participants of similar programs, both prior to and after program exit.

APPENDIX A: DETAILED METHODOLOGY

Hezel Associates implemented a mixed methods evaluation to conduct a formative and summative evaluation of the CPAM TAACCCT Round 4 project implementation and outcomes. The evaluation is designed to answer the following questions.

1. How was the particular curriculum selected, used, or created?
2. How was the program managed and implemented?
3. How are CPAM colleges conducting in-depth assessments of participant's abilities, skills, and interests to select or enroll individuals into the program?
4. What strategies were used to provide career guidance for prospective and current CPAM participants?
5. What contributions did each of the partners (employers, workforce system, other training providers and educators, philanthropic organizations, and others as applicable) make in terms of (a) program design, (b) curriculum development, (c) recruitment, (d) training, (e) placement, (f) program management, (g) leveraging of resources, and (h) commitment to program sustainability?
6. To what extent were credit for prior learning protocols implemented?
7. To what extent did the use of new technology impact program implementation?
8. What scale-up and sustainability opportunities exist for CPAM colleges?
 - 8.5 To what extent are CPAM programs or content adaptable to other fields?
 - 8.6 What is the capacity of CPAM colleges to react to the economy and adapt to other fields?
9. What were the outcomes in terms of students' attainment of certifications, certificates, diplomas, or other recognized credentials as a result of CPAM?
10. What impact did the CPAM programs have on participants' employment outcomes?

The following sections detail the data collection and analysis process applied throughout the evaluation.

Data Collection

Throughout the 4-year grant, Hezel Associates collected data from a variety of stakeholders using multiple methods. Each data collection method is described below.

Document Review

Hezel Associates developed the Document Review Framework (see Appendix B) to assess implementation fidelity. The framework is a matrix that outlines project activities, milestones, and deliverables stipulated in the CPAM proposal to the USDOL. The framework also includes space for evaluators to record the date each milestone was accomplished, the status of meeting the milestones, and the evidence provided to demonstrate meeting the milestones. This instrument allowed Hezel Associates to address evaluation questions 1 through 6.

Consortium partners shared various project-related documents with Hezel Associates over the 4-year period to demonstrate progress toward the five overarching strategies: (1) build an easily navigable statewide Career Pathways system, (2) create a statewide system of student supports, (3) connect information and communication for data-driven decision making, (4) employ

technology to strengthen programming and delivery statewide, and (5) construct strategic partnerships with stakeholders. Documents were shared on Dropbox, Hezel Associates logged the document title, date, and a brief description, and recorded notes in the framework describing how the documentation supports completion of or progress toward meeting the priorities.

Staff Interviews

Hezel Associates developed a semi-structured Staff Interview Protocol (see Appendix C) to guide conversations with project staff. The Staff Interview Protocol contains 14 open-ended items that address organizational structure and governance, curriculum development, program design, partner support, suggestions to strengthen the project, program sustainability, and overall impressions of the project. Interview items were aligned with evaluation questions 1 through 8.

There were four rounds of staff interviews throughout the project period, starting at the end of the Spring 2015 semester. Each round, the Project Director provided Hezel Associates with a contact list of individuals involved in the TAACCCT 4 project. The evaluator contacted each individual via email, describing the background of the evaluation and purpose of the interview, and asking for their availability to participate in an interview. A reminder email was sent a week later to those who had not yet responded. Once staff responded with dates and times they were available for an interview, the evaluator sent a confirmation email with a consent document attached. Interviews were recorded with participant permission and later transcribed for analysis. Table A1 displays the number of individuals recruited for each round of interviews, the number of individuals who participated, and the colleges represented.

Table A1. Staff Interview Participation Rate

Year	Recruited	Participated	Colleges
Spring 2015	29	25	14
Spring 2016	29	19	12
Spring 2017	26	8	7
Spring 2018	27	16	11

Employer Interviews

Hezel Associates developed a semi-structured Employer Interview Protocol (see Appendix D) to guide conversations with employer partners. Items were semi-structured and developed to gather feedback from local employer partners who have participated in program development, or who have interacted with students who enrolled in the programs. The protocol consists of seven open-ended items that aim to answer evaluation questions 1, 2, and 5. Employer interview items cover topics such as the background of the company, their involvement with CPAM, and alignment of the programs to industry needs.

There were two rounds of employer interviews, starting at the end of the Spring 2016 semester. For each round, the Project Director provided Hezel Associates with a contact list of local industry partners involved in the TAACCCT 4 project. The evaluator contacted each individual via email, describing the background of the evaluation and purpose of the interview, and asking for their availability to participate in an interview. A reminder email was sent a week later to those who had not yet responded. Once the employers responded with dates and times they were

available for an interview, the evaluator sent a confirmation email with a consent document attached. Interviews were recorded with participant permission and later transcribed for analysis. Table A2 displays the number of individuals recruited for each round of interviews, as well as the number of individuals who participated.

Table A2. Employer Partner Interview Participation Rates

Year	Recruited	Participated
2017	8	4
2018	8	1

Student Focus Groups

Hezel Associates developed a semi-structured focus group protocol to gather student perceptions of the TAACCCT Round 4 grant-funded programs (Evaluation Questions 1, 2, 3, 5, and 8). The protocol contains six open-ended items, covering topics such as enrollment, program experiences, technology, and career plans. The Student Focus Group Protocol is included as Appendix F.

Hezel Associates conducted in-person focus groups in grant years 2 and 3. The Project Director worked with consortium partners to recruit participants for the focus groups. In total, 11 focus groups were conducted with cyber technology students from 9 partner colleges. Two Hezel Associates researchers visited the schools on the scheduled date. One researcher conducted the focus group while the other supported by taking notes. The size of the focus groups ranged from two to eight students. Focus groups were recorded with the permission of the participants and transcribed later for analysis. Students who did not consent to participating in the focus group or being recorded were asked to leave before the session started. Table A3 displays the colleges represented by focus groups and the semester the focus group was conducted.

Table A3. Participating Colleges

School	Semester
Alleghany College of Maryland	Spring 2017
Baltimore City Community College	Spring 2017
Harford Community College	Spring 2017
Carroll Community College	Spring 2016
Community College of Baltimore County	Fall 2015 & Spring 2016
Frederick Community College	Fall 2015
Hagerstown Community College	Fall 2015 & Spring 2016
Howard Community College	Fall 2015
Montgomery College	Fall 2015

Student Questionnaire

Hezel Associates developed a 33-item questionnaire to gather student perceptions of the TAACCCT Round 4 grant-funded programs and to address evaluation questions 4 and 8. The questionnaire covered topics such as enrollment, credentials, student support, program satisfaction, work experience, employment and wages, and demographics. The questionnaire was

administered online using Qualtrics software. Staff from consortium colleges emailed the questionnaire URL to students who had participated in grant-funded programming. The questionnaire was administered in spring 2017, resulting in 166 usable responses representing nine colleges. The Student Questionnaire is included as Appendix E.

Employment Questionnaire

Hezel Associates developed a 14-item questionnaire to gather student outcomes data to address evaluation questions 9 and 10. The questionnaire covered topics such as enrollment, credentials, student support, program satisfaction, work experience, employment and wages, and demographics. The Student Questionnaire is included as Appendix E.

The questionnaire was administered online using Qualtrics software. Staff from consortium colleges emailed the questionnaire URL to students who had participated in grant-funded programming. In addition, college staff were provided a script to call students in an effort to increase response rates. The questionnaire was administered in summer 2018, resulting in 166 usable responses. The following list describes the demographics of students who participated in the questionnaire

Data Analysis

Hezel Associates analyzed data from each data collection method separately, then summarized, compared, and synthesized findings to answer the evaluation questions. The analysis methods used for the evaluation are described in the following sections.

Document Review

Hezel Associates collected and sorted program documentation uploaded to Dropbox, compiling a list of documents received, along with a brief description of the contents of important documents. Once documents were collected and sorted, each document was compared against the Document Review Framework. Hezel Associates described document content and a description of what project staff have done to justify fulfilling project milestones under “Evidence.” The dates project staff fulfilled each milestone, based on document dates, were listed under “Date.” Hezel Associates marked the status for meeting the listed milestones as (a) “met with documentary evidence,” (b) “met through self-reporting,” (c) “not met,” or (d) “in progress.” In addition, for milestones that were met, Hezel Associates noted fidelity to the work plan timeline. Notes recorded under “Evidence” were analyzed for concepts related to evaluation questions 1 through 6.

Interviews/Focus Groups

Hezel Associates used an open-coding system that cultivated into an emergent scheme to guide interview and focus group analysis. This allowed for ideas and concepts to develop as the evaluator analyzed the data. Narrative from interview transcripts was parsed into bits of content and fit to the emergent coding system. The evaluator identified patterns, which became themes that represented the conceptual relationships between and/or among activities and related outcomes. This recursive process systematized turning bits of information into descriptions, raising descriptions to low-level inferences, and transforming inferences into higher-level interpretations, thus allowing for conclusions to be established.

Student Questionnaire

Hezel Associates performed descriptive statistics on the Student Questionnaire data, including frequencies, percentages, means, and standard deviations, as appropriate.

Employment Questionnaire

Hezel Associates performed descriptive statistics on the Employment Questionnaire data, including frequencies, percentages, means, and standard deviations, as appropriate.

Extant Student Data

Hezel Associates performed descriptive statistics on extant data, including frequencies, percentages, means, and standard deviations, as appropriate. Additionally, inferential statistics were conducted, including paired and independent samples *t*-tests to assess employment outcomes.

APPENDIX B: DOCUMENT REVIEW FRAMEWORK

CPAM TAACCCT Grant Document Review Framework

Format	Qualitative research to assess fidelity with which program activities were implemented and in compliance with the timeline.
Timeline	Data collection and analysis will be conducted annually in August.
Process	<p>Documents will be collected through the Project Director and other CPAM staff. Documentation will be provided to Hezel Associates via email or secure file transfer protocol (SFTP) using Hezel Associates' or Montgomery College's internal server dependent upon the sensitivity of the documentation.</p> <p>The activities in the work plan will guide the identification of documentation to use as evidence.</p> <p>Once documents have been collected and sorted, content in each document will be examined and entered in the following matrix aligned with the appropriate milestones. Hezel Associates will list each document and what Montgomery College has done to justify fulfilling that milestone under Evidence. The date that that dimension was fulfilled will be listed under Date. Status for meeting the listed milestones will be marked met with documentary evidence, met through self-reporting, not addressed by the documentation, or in progress. In addition, status will be noted with categories in reference to timeframe including met within the timeframe, met outside of the timeframe, and met with no indication of timeframe.</p>
Instructions	Provide documentation supporting milestones and activities listed in the following matrix. Include any evidence of program implementation and compliance with timeline. Documents can be submitted as attachments via email or using Hezel Associates' or Montgomery College's internal server if documents contain sensitive information. The Project Director, or other CPAM staff, will fill out the accompanying document record Excel file listing the document description and associated milestone. Hezel Associates will fill in Date, Status, and Evidence boxes of the document review framework during analysis.
Definitions	<p>Milestone: Milestones as listed in the work plan included in the technical proposal</p> <p>Proposed Date: End Date listed in the workplan</p> <p>Completed Date: Date the milestone was met if provided in the documentation</p> <p>Status: Status for meeting milestones: met with documentary evidence, met through self-reporting, not addressed by the documentation, in progress, met within the timeframe, met outside of the timeframe, and met with no indication of timeframe</p> <p>Evidence: Document providing evidence of milestone and explanation for how the milestone was fulfilled</p>

General Implementation Activities				
0.1 Staff CPAM and College Programs				
Milestones	Proposed Date	Completion Date	Status	Evidence
a. Interviews and Selection Hires	3/2015			
b. Core Staff hired	3/2015			
0.2 Procure equipment and program platforms				
Milestones	Proposed Date	Completion Date	Status	Evidence
a. Put out RFPs	9/2015			
b. Review RFPs	9/2015			
c. Selection and contracts	9/2015			
0.3 Outreach campaign/Community Awareness				
Milestones	Proposed Date	Completion Date	Status	Evidence
a. Community meetings	9/2016			
b. Post information on college and partner websites	9/2016			
c. Technical assistance on assessment tool	9/2016			
0.4 Formalize intake process				
Milestones	Proposed Date	Completion Date	Status	Evidence
a. Formal checklist for intake; PLA and other assessments, benefits screenings, and log in to CPAM and WIB sites	3/2015			

Strategy 1: Build an easily navigable statewide Career Pathways system that actively engages stakeholders and features on-ramps to training and off-ramps to good jobs for workers of all educational and skill levels				
Activity 1.1: Contextualized GED program				
Milestones	Proposed Date	Completion Date	Status	Evidence
a. Review findings of Mi-BEST programs	9/2015			
b. Survey of available modules to adapt	9/2015			
Activity 1.2: Adapt Cyber Technology Certificate consortium wide				
Milestones	Proposed Date	Completion Date	Status	Evidence
a. Faculty/staff trainings on implementation toolkit	9/2015			
b. Hiring of necessary faculty	9/2015			
c. Pilot cohorts	9/2015			
Activity 1.3: New modules on developments in Cyber				
Milestones	Proposed Date	Completion Date	Status	Evidence
a. Survey existing resources	9/2015			
b. Survey employers for needs	Annually			
c. Launch modules	9/2016			
Activity 1.4: Updates to Cyber Security and Networking AAS tracks to align with new NSA guidelines				
Milestones	Proposed Date	Completion Date	Status	Evidence
a. Map existing curricula against new guidelines and 4-year curricula	9/2015			
b. Convene employers to ensure alignment	9/2015			
c. Train faculty on updates	9/2015			

STRATEGY 2: Create a statewide system of student supports that address academic and non-academic needs, leading to better retention, and accelerates student outcomes through a variety of proven strategies				
Activity 2.1: Implement bridge programs				
Milestones	Proposed Date	Completion Date	Status	Evidence
a. Faculty/staff trainings on implementation toolkit	9/2017			
b. Implementation of Cyber bridge	9/2016			
Activity 2.2: Prior Learning Assessment				
Milestones	Proposed Date	Completion Date	Status	Evidence
a. Convene PLA task force	9/2015			
b. Master PLA document of existing practices complete	9/2015			
c. Preliminary plan submitted to MHEC/USM for approval	9/2015			
Activity 2.3: Comprehensive internship program				
Milestones	Proposed Date	Completion Date	Status	Evidence
a. Ongoing outreach with employers to expand/deepen partnerships	9/2018			
b. Training on virtual internship platform	9/2018			
Activity 2.4: Point of need coaching				
Milestones	Proposed Date	Completion Date	Status	Evidence
a. Co-located Project Navigators at colleges and WIBs/OneStops	9/2018			
b. Procure expertise for online advising system	9/2018			
c. Training in using available data	9/2018			
Activity 2.5: Data analysis training				
Milestones	Proposed Date	Completion Date	Status	Evidence
a. Ongoing training for staff and faculty on accessing and interpreting data to support students	9/2018			

STRATEGY 3: Connect information and communication to assist participants in making informed choices and allow for data driven analysis to inform Consortium decision-making, continuous improvement, and planning				
Activity 3.1: Shared data gathering systems in place				
Milestones	Proposed Date	Completion Date	Status	Evidence
a. Data collection and compilation system developed and launched	9/2015			
b. Ongoing data collected from colleges, departmental heads, and data departments	9/2015			
c. Quarterly and annual reports on program and on access, retention, and completion	9/2015			
Activity 3.2: Create program web portal				
Milestones	Proposed Date	Completion Date	Status	Evidence
a. Procure data specialist	9/2016			
b. Launch	9/2016			
c. Continuous improvement and expansion	ongoing			
Activity 3.3: Employment Results Scorecard				
Milestones	Proposed Date	Completion Date	Status	Evidence
a. Procure Evaluator	9/2018			
b. Evaluator established comparison cohort	9/2018			
c. Quarterly reports issued	9/2018			
d. Final report issued	9/2018			
Activity 3.4: Third Party Evaluation of Program				
Milestones	Proposed Date	Completion Date	Status	Evidence
a. Procure Evaluator	9/2018			
b. Evaluator established comparison cohort	9/2018			
c. Quarterly reports issued	9/2018			
d. Final report issued	9/2018			

STRATEGY 4: Employ technology to strengthen programming and delivery and increase statewide access to high-quality coursework, instruction, simulations and labs, and work-based learning opportunities				
Activity 4.1: Launch virtual labs/simulations platform				
Milestones	Proposed Date	Completion Date	Status	Evidence
a. Trainings	9/2015			
b. Adapt existing lab materials for online platform	9/2015			
c. Survey employers for training gaps	9/2015			
d. Develop new lessons	9/2015			
Activity 4.2: Virtual internship platform				
Milestones	Proposed Date	Completion Date	Status	Evidence
a. Procure vendor	9/2015			
b. Pilot and improvements	9/2015			
c. Ongoing trainings for members	9/2015			
Activity 4.3: Adapt Assurance certificate into a competency based/modular format				
Milestones	Proposed Date	Completion Date	Status	Evidence
a. Procure platform	9/2016			
b. Consult with SMEs on design	9/2016			
c. Launch pilot	9/2016			
d. Train staff and other colleges	9/2016			
Activity 4.4: Adapt Cyber Technology Certificate to a personally adaptive platform				
Milestones	Proposed Date	Completion Date	Status	Evidence
a. Procure platform	9/2016			
b. Consult with SMEs on design	9/2016			
c. Launch pilot	9/2016			
d. Training of staff and other colleges	9/2016			

STRATEGY 5: Construct strategic partnerships that engage, employers and leverage resources to create a durable network of relationships that meet the needs of employers, students, and other stakeholders over time				
Activity 5.1: Advisory Council				
Milestones	Proposed Date	Completion Date	Status	Evidence
a. Convene at least quarterly for formal data reviews	9/2018			
b. Communities of practice around specific topics	9/2018			
Activity 5.2: Communities of practice on specific topics				
Milestones	Proposed Date	Completion Date	Status	Evidence
a. Ongoing communities of practice established on topics of urgency	9/2018			
Activity 5.3: Formal program reviews				
Milestones	Proposed Date	Completion Date	Status	Evidence
a. Quarterly (or as-needed) meetings to review curricula and map against core competencies	9/2018			

APPENDIX C: STAFF INTERVIEW PROTOCOL

Organizational Structure/Management

1. Please describe your role in the CPAM consortium.
2. What are your perceptions of the project organization and/or management?²
(*Probe: level/type of communication, inclusion, delegation of responsibilities, suggestions for changes or improvements*)

Curriculum Development

3. Did your school developing new curriculum? (*If yes, go to Q6*)
4. Could you walk me through the curriculum development process?¹
(*Probe: how it was/will be selected/created/used, communication methods, plan for industry alignment, challenges, success, credentials/certifications/degrees*)

Program Implementation

5. Can you describe your college's processes for assessing CPAM prospective students' skills and abilities?³
(*Probe: soft skills, IT skills, changes since the start of the grant*)
6. What are your college's processes and/or policies for assessing prior learning and experiences for credit?⁶ (*Probe: changes since the start of the grant*)
7. How does your college provide career guidance for both prospective and current CPAM students?⁴
(*Probe: differences from other students*)
8. Could you describe any successes or challenges your college has had integrating new technologies or equipment?⁷ (*Probe: impact on implementation, student usage*)

Partner Support

9. Can you tell me about the contributions that partners have made or are planning to make to the program?⁵
(*Examples—employers, workforce agencies, external education providers with program design, curriculum, recruitment, training, resources, or commitment to sustainability*)
(*Probe: factors impacting involvement, most and least critical contributions, challenges, successes*)

Instruction

Now thinking about your experience teaching Cyber Technology courses...

10. What are some of the changes in your experiences teaching since the CPAM project started?¹

(Probe: new position, updated content, new methods, course or program structure, students)

11. What were your experiences integrating new technology into the Cyber Technology courses?⁷ *(Probe: challenges and successes)*

Conclusion

12. Describe any capacity building that you expect to see as a result of this project.⁸

(Probe: programmatic, procedural, cultural)

13. Can you describe any plans for sustaining your program once the grant is over?⁸

14. What is your overall opinion of the CPAM project?

Thank you, that's it for my questions, is there anything else you'd like to add?

APPENDIX D: EMPLOYER INTERVIEW PROTOCOL

Involvement in CPAM

1. To begin, tell me a little about your company/organization.
2. Could you describe your involvement in the Cyber Technology program at [COLLEGE]?^{1, 5}
(Probe: new relationship or existing, curriculum development, factors impacting involvement, challenges, successes)
3. What are your future plans for involvement with the CPAM project or the Cyber Technology program at [COLLEGE]?^{1, 5}
(Probe: curriculum development, hiring)
4. How will the program affect your organization/company?⁵
(Probe: hiring of workers, different employee skill sets, current employee training)
5. How do you envision the Cyber Technology program fitting into the future labor market in your region?^{8, 1}
(Probe: transferable skills and content knowledge)

Conclusion

6. What is your overall opinion of the CPAM project?

What about the curriculum specifically?¹

7. Do you have any suggestions for improving the project?
(Draw from any negative answers to previous question)

APPENDIX E: PARTICIPANT FOCUS GROUP PROTOCOL

Questions

1. As I mentioned, we want to learn about your experiences in the Cyber Technology program. To start off, I'd like to hear about your experiences enrolling and participating in the program.
(Probe: why did you pick it, what do/don't you like about it, was it a good choice)
2. Obviously accumulating enough college credits is an important part of completing your program, so I'm interested in the different ways students have earned credits. Can you describe your experiences earning credits for your program?^{3, 6}
(Probe: PLA)
3. What is your opinion of the equipment and technology used for your program?⁷
(Probe: issues, benefits)
4. What are some of the ways your program is preparing you for a career in Cyber Technology?⁴
(Probe: skills, career guidance, internships, job search, interactions with local employers)
5. What are your plans once you leave your program?
(Probe: credentials, employers, career path)
6. What is your overall opinion of the program?
(Probe: suggested changes)

What else would you like to share about your program that we have not discussed?

APPENDIX F: PARTICIPANT QUESTIONNAIRE

CPAM TAACCCT Round 4 Participant Questionnaire

Page 1

CPAM Participant Questionnaire

Thank you for participating in this survey! Your feedback will potentially help improve the Cyber Technology Pathways Across Maryland (CPAM) programs across the state.

This survey will take approximately 5 minutes. Be assured that your individual responses are confidential and will be reported only as part of group feedback.

Page 2

1. Are you 18 years of age or older?

- Yes
- No *[Go to Termination Page]*

[Required question]

Page 3

2. Please indicate the college where you were enrolled in a Cyber Technology program. If you have enrolled in more than one of these colleges, please choose the one where you enrolled most recently.

- Allegany College of Maryland
- Anne Arundel Community College
- Baltimore City Community College
- Carroll Community College
- College of Southern Maryland
- Community College of Baltimore County
- Frederick Community College
- Garrett College
- Hagerstown Community College
- Harford Community College
- Howard Community College
- Montgomery College
- Prince George's Community College
- Wor-Wic Community College
- Unsure *[Go to Termination Page]*
- None of these *[Go to Termination Page]*

[Required question]

Page 4

3. Why did you enroll in the Cyber Technology program at [college]? Mark all that apply.

- Interest in the field
- To gain new skills
- To get a job
- To receive a promotion at my current place of employment
- To receive higher wages
- Other _____

4. Are you still enrolled in your Cyber Technology program at [college]?

- Yes [Go to Q8]
- No
- Unsure

[Required question]

Page 5

5. Did you...

- complete the program (earn a credential, certificate, or associate's degree)?
- withdraw from the program without completing a credential, certificate, or associate's degree?
- other _____

[If "Complete the program" or "Other," go to Q5]

Page 6

6. Why did you withdraw from the program? Mark all that apply.

- Completed what I intended to
- Conflict with work schedule
- Decided program was not what I wanted
- Difficulty with program requirements
- Family or other external obligations
- Financial difficulties
- Found a job
- Medical issues
- Program was different than expected
- Transferred to another college
- Transferred to another program at the college
- Prefer not to answer
- Other _____

Page 7

7. Are you now employed at a job relevant to your program or course(s)?

- Yes
- No

8. Which best describes your work experience before you began your Cyber Technology program?

- I did not have any prior work experience.
- I had experience in a field similar to my program.
- I had experience in an unrelated field.

9. Before enrolling in your Cyber Technology program, what was the highest level of education you completed?

- Completed some high school
- High school diploma or equivalent
- Some college
- Earned a one-year (or less) certificate
- Associate's (2-year) degree
- Bachelor's (4-year) degree
- Master's degree
- Doctoral degree
- Other _____

Page 8

Assessment tools

10. Did you receive credits for your work experience or military service?

- Yes
 - No [*Go to Q12*]
 - Unsure [*Go to Q12*]
- [*Required question*]

Page 9

11. Did you use the CPAM online assessment tool?

- Yes
- No
- Unsure

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STEM and Cyber Readiness

12. Did you participate in the STEM Readiness program?

- Yes
 - No
 - Unsure
- [*Required question*]

13. Did you participate in the Cyber Readiness program?

- Yes
- No
- Unsure

[Required question]

[If “No” or “Unsure” for BOTH (Q12 & Q13) go to Q15]

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14. To what extent do you agree or disagree with the following statements?

Participating in the STEM and/or Cyber Readiness programs...

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree	Not applicable
a. helped prepare me for my Cyber Technology program								
b. improved my math skills								
c. improved my computer skills								
d. improved my reading skills								
e. improved my workforce skills								

Page 12

New Technology

15. What kind of technology was used for your program? Mark all that apply.

- FireEye
- NETLABS+
- Virtual servers
- Other: _____

16. To what extent do you agree or disagree with the following statements?

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree	Not applicable
a. Instructors had appropriate expertise in the technology used								
b. New technology was integrated smoothly								
c. The technology used was up-to-date in the field of Cyber Security								
d. Technology is used in the Cyber Security industry, so I am prepared for my career								

Page 13

The following are meant to understand your use of any Career Guidance resources while at [college].

17. Have you used any of the following at [college]? How satisfied were you with the resource?

	Did you use...				If yes, how satisfied were you with the service?						
	Yes	No	Unsure	Prefer not to answer	Very dissatisfied	Dissatisfied	Somewhat dissatisfied	Neutral	Somewhat satisfied	Satisfied	Very satisfied
a. Career Navigation Tool											
b. Career Navigator											
c. Career services											
d. Experiential Learning Coordinator											

[If Q17a = "Yes," go to Q18]

18. Did you use the Career Navigation tool to... Mark all that apply.

- decide if [PROGRAM] was the right program for you?
- find an internship or apprenticeship?
- identify potential employers for job opportunities?
- understand the career pathway for Cyber Technology?

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19. Choose which best describes your employment status since completing the Cyber Technology program.

- I am working at the same company I was at before I started the program. *[Go to Q20]*
 - I am working at a different company than I was working at before I started the program. *[Go to Q21]*
 - I am not employed. *[Go to Q27]*
- [Required question]*

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20. After completing the program, which best describes your status with your company?

- I have the same job I had before I started the program.
- I moved to an equivalent position with a similar salary range and job title.
- I was promoted.
- I was demoted.
- Unsure

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21. Is your current job related to the Cyber Technology program you completed?

- Yes
- No
- Unsure

[If Q19 = "I am working at the same company...", go to Q10]

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22. Which of the following, if any, helped you get this job? Mark all that apply.

- An instructor helped me make a connection with the company
- Apprenticeship or internship
- College-organized tour of employer facility
- Experiential Learning Coordinator
- Made a connection with the employer when they visited my college
- Program Navigator
- None of the above
- Other _____

23. Does the education you received in your Cyber Technology program satisfy at least the minimum requirements for your current job?

- Yes
- No
- Unsure

24. How would you describe the changes, if any, to your wages from before your enrollment to after you left the Cyber Technology program?

- My wages increased.
- My wages stayed about the same.
- My wages decreased.

25. How would you describe the changes, if any, to your employment options (e.g., number of jobs you qualified for) from before your enrollment to after you left the Cyber Technology program?

- My employment options stayed the same.
- I had more options for employment than before.
- I had less options for employment than before.
- Unsure

26. Thinking about your current employment, please rate the extent to which you agree or disagree with the following statements:

My Cyber Technology program prepared me with the ability to do the following in a work setting...

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree	Not applicable
a. Apply math skills								
b. Apply quality control knowledge								
c. Apply technical skills								
d. Apply writing skills								
e. Effectively communicate								
f. Lead groups of people								
g. Manage my time								
h. Operate equipment used in the industry								
i. Prioritize tasks								
j. Troubleshoot technical problems								
k. Use required computer software								
l. Work as a member of a team								

Support services

The following are meant to understand your use of any support services while at [college].

27. Have you used any of the following at [college]? How satisfied were you with the service?

	Did you use...				If yes, how satisfied were you with the service?						
	Yes	No	Unsure	Prefer not to answer	Very dissatisfied	Dissatisfied	Somewhat dissatisfied	Neutral	Somewhat satisfied	Satisfied	Very satisfied
a. Academic advising											
b. Child care											
c. Counseling											
d. Digital tutoring											
e. Financial aid											
f. In-person tutoring											
g. Peer mentoring											

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28. Please indicate whether you were aware of the following activities/services within the Cyber Technology program and whether or not you participated.

	Yes, aware	No, not aware	If you marked aware, mark if you have ever participated in this activity/service
a. Cyber Readiness			
b. Cyber Technology job fairs			
c. Interview guidance			
d. Job shadowing			
e. One-on-one career advising			
f. Registered apprenticeship			
g. Résumé writing assistance			
h. STEM Readiness			
i. Virtual internship			

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29. What is your gender?

- Male
- Female
- Prefer not to answer

30. Which of the following best describes you?

- American Indian/Alaska Native
- Asian
- Black/African American
- Hispanic/Latino
- Native Hawaiian/Other Pacific Islander
- White
- Prefer not to answer
- Other _____

31. Do any of the following apply to you?

	Yes	No	Unsure	Prefer not to answer
Pell Grant recipient				
Student with a disability				
Trade Adjustment Assistance (TAA)-eligible				
Veteran or Spouse eligible for Priority of Service				

32. What is your age? *Numeric responses only.*

33. Please share any additional comments you may have about your experience with the Cyber Technology program at [college]:

Completion Page

Thank you for completing the questionnaire!

Termination Page

Unfortunately, your responses do not meet the criteria for this questionnaire. Thank you for participating!

APPENDIX G: EMPLOYMENT QUESTIONNAIRE

CPAM TAACCCT Year 4

CPAM Participant Questionnaire Phone Script

Phone Interview Instructions

1. Call students and ask them the questions on the questionnaire (follow the introductory script)
2. Use the link provided to manually enter the student responses (the link can be used as many times as needed)

[\[Survey Link\]](#)

Phone Interview Introduction

Hello, this is _____ from [College Name]. I'm calling to ask a few questions about your employment and experience with the cyber security program you attended.

The cyber security program for which you are currently or were formerly enrolled is part of a nationwide effort to help train America's workforce. The Cyber Technologies Across Maryland (CPAM) program is one of many United States Department of Labor-funded programs aiming to prepare students for high-wage, high-skill employment. As an individual who enrolled in a CPAM program, we are hoping to gain feedback about your experience.

Your feedback will be used to inform improvements of Cyber Security programs to help future students. Individual responses are confidential and will be reported only as part of group feedback—there will be no link to you specifically. Therefore, there is no risk of embarrassment or harm, as identities will be protected. Your decision about whether or not to participate will not affect your current or future relations with your school. If you decide to participate, you are free to withdraw at any time from this study.

Do you agree to participate in the interview?

Please provide the following information:

Student ID	
Email Address	
First Name	
Last Name	
School	

CPAM Participant Questionnaire

1. Which of the following describes your enrollment status?

- I completed the program, earning a credential, certificate, or associate's degree.
- I withdrew from the program without completing a credential, certificate, or associate's degree.
- I am still enrolled

[If "withdraw" or "still enrolled" go to Q4]

2. Which semester did you earn your degree or certificate? (Please select all that apply)

- Fall 2015
- Spring 2016
- Summer 2017
- Fall 2016
- Spring 2017
- Summer 2017
- Fall 2017
- Spring 2018

3. Which type of college credential did you earn? (Please select all that apply)

- 2-year degree
- Certificate (credit)
- Certificate (non-credit)

4. Which of the following industry-recognized credentials have you earned? (Please select all that apply)

- A+
- CCNA
- CEH
- CISA
- Linux+
- Network+
- Security+
- Other

5. Are you currently employed?

- Yes
- No

6. Please enter the title of your current position (e.g. cyber security analyst).

- [enter text]

- 7. Please enter the date when you were hired for your current position.**
- [enter date month/year]
- 8. Please enter the name of the company/organization where you currently work.**
- [enter text]
- 9. Please estimate your current hourly wages (hourly, weekly, monthly) or annual salary.**
- [Hourly/weekly/monthly/annually]
- 10. As a result of the Cyber Technology program...**
- My wages increased.
 - My wages stayed about the same.
 - My wages decreased.
- 11. As a result of the Cyber Technology program...**
- My employment options have stayed the same.
 - I have more options for employment than before.
 - I have less options for employment than before.
 - I'm not sure yet how my employment options have changed.
- 12. Did faculty, career counselors, or other college staff help you find employment?**
- Yes
 - No
- 13. Please write any additional comments in the space below.**

Completion Page: Thank you for completing the questionnaire!

APPENDIX H: EMPLOYMENT QUESTIONNAIRE DATA TABLES

Table 1. CPAM Colleges

Colleges (n = 715)	n	%
Allegany Community College	23	3.2
Baltimore City Community College	83	11.6
Community College of Baltimore County	104	14.5
Frederick Community College	36	5.0
Garrett College	17	2.4
Hagerstown Community College	42	5.9
Harford Community College	78	10.9
Howard Community College	77	10.8
Montgomery College	203	28.4
Prince George's Community College	32	4.5
University of Maryland College	1	0.1
Wor-Wic Community College	19	2.7

Note: 90 respondents could not be not be matched to a college.

Table 2. Enrollment Status

Enrollment (n = 800)	n	%
Still currently enrolled	251	31.4
Completed, earning credential, certificate, or associate degree	432	54.0
Withdrew, without earning credential, certificate or associate degree	117	14.6

Table 3. Semester Earned Credential(s)

Semester (n = 413)	n	%
Fall 2015	10	2.4
Spring 2016	35	8.5
Summer 2016	8	1.9
Fall 2016	37	9.0
Spring 2017	87	21.1
Summer 2017	51	12.3
Fall 2017	82	19.9
Spring 2018	86	20.8
Multiple Semesters ^a	17	4.1

^a: Students indicating that they earned credentials in more than one semester.

Table 4. Credential(s) Earned

Credentials (n = 422)	n	%
2-year degree	238	56.4
Credit certificate	73	17.3
Non-credit certificate	131	31.04

Note: Respondents were allowed to select more than one credential type that was earned.

Table 5. Industry Certification Earned

Certifications (n = 309)	n	%
A+	154	49.84
CEH	2	0.65
CCNA	37	11.97
CISA	2	0.65
Linux+	10	3.24
Network+	106	34.40
Security+	119	38.51
Other ^a	55	17.80

Note: Respondents could select more than one industry-recognized earned credential.

^a: Other certifications included Cyber Ops, ITIL, PMP, CAHIMS, Cloud Essentials, GX Security Essentials, Certified Help Desk, Certified Engineer, Cyber Security, CISCO, MCSA, Test out, Cloud+, CCENT, Ethical Hacker, NetPro, Certified Data Recovery, CCNP Routing, OSCP, CompTIA, Java Bootcamp, GSEC, GCIH, SPLUNK, and MTA

Table 6. Employment Status

Employment (n = 778)	n	%
Yes, I am currently employed	557	71.6
No, I am not currently employed	221	28.4

Table 7. Wage Cycle

Wage Cycle (n = 359)	n	%
Annual salary	125	34.8
Hourly wage	220	61.3
Weekly wage	6	1.7
Monthly wage	8	2.2

Table 8. Wage Rate by Pay Cycle

Wages	M	SD	Median	Min	Max
Annual salary	58233.80	28848.12	55000.00	5750.00	180000.00
Hourly wage	17.36	9.32	15.00	3.63	97.50
Weekly wage	304.54	364.41	250.00	7.25	1000
Monthly wage	2333.29	2248.96	1333.00	600.00	7000.00

Table 9. Changes to Wage Status

Wage Changes (n = 499)	n	%
Increases in wage	181	36.3
Wages stayed about the same	308	61.7
Decreases in wage	10	2.0

Table 10. Changes to Employment Options

Employment Options (n = 696)	n	%
More employment options	358	51.4
Same employment options	153	22
Less employment options	6	0.9
Not sure how employment options changed	179	25.7

Table 11. College Staff Support with Finding Employment

Staff Support (n = 683)	n	%
Yes	242	34.4
No	461	65.6

Table 12. Enrollment Status by College

	Enrolled		Completed		Withdrew	
	n	%	n	%	n	%
Allegany Community College (n = 23)	0	-	23	100.0	-	-
Baltimore City Community College (n = 83)	1	1.2	67	80.7	15	18.1
Community College of Baltimore County (n = 103)	69	67.0	25	24.3	9	8.7
Frederick Community College (n = 36)	8	22.2	28	77.8	0	-
Garrett College (n = 17)	0	-	13	76.5	4	23.5
Hagerstown Community College (n = 42)	9	21.4	31	73.8	2	4.8
Harford Community College (n = 77)	29	37.7	29	37.7	19	24.7
Howard Community College (n = 76)	46	60.5	21	27.6	9	11.8
Montgomery College (n = 202)	49	24.3	115	56.9	38	18.8
Prince George's Community College (n = 31)	4	12.9	26	83.9	1	3.2
University of Maryland College (n = 1)	0	-	1	100.0	0	-
Wor-Wic Community College (n = 19)	8	42.1	8	42.1	3	15.8

Table 13. Earned Credential Semester by College

	Fall 2015		Spring 2016		Summer 2016		Fall 2016		Spring 2017	
	n	%	n	%	n	%	n	%	n	%
Allegany Community College (n = 23)	0	-	0	-	0	-	1	4.3	8	34.8
Baltimore City Community College (n = 83)	1	1.5	1	1.5	0	-	5	7.5	22	32.8
Community College of Baltimore County (n = 103)	0	-	1	4.2	0	-	4	16.7	3	12.5
Frederick Community College (n = 36)	0	-	1	3.6	0	-	1	3.6	2	7.1
Garrett College (n = 17)	0	-	5	38.5	0	-	0	-	6	46.2
Hagerstown Community College (n = 42)	0	-	2	6.7	1	3.3	9	30.0	6	20.0
Harford Community College (n = 77)	0	-	2	6.9	0	-	3	10.3	1	3.4
Howard Community College (n = 76)	0	-	1	5.0	0	-	0	-	4	20.0
Montgomery College (n = 202)	6	5.6	17	15.9	5	4.7	10	9.3	20	18.7
Prince George's Community College (n = 31)	1	4.2	1	4.2	0	-	1	4.2	9	37.5
University of Maryland College (n = 1)	0	-	0	0.0	0	-	0	-	-	-
Wor-Wic Community College (n = 19)	0	-	2	25.0	1	12.5	0	-	2	25.0

Table 14. Earned Credential Semester by College, Continued

	Summer 2017		Fall 2017		Spring 2018		Multi-Semester	
	n	%	n	%	n	%	n	%
Allegany Community College (n = 23)	1	4.3	2	8.7	11	47.8	0	-
Baltimore City Community College (n = 83)	21	31.3	8	11.9	1	1.5	8	1
Community College of Baltimore County (n = 103)	0	-	4	16.7	12	50.0	0	-
Frederick Community College (n = 36)	4	14.3	6	21.4	11	39.3	3	11
Garrett College (n = 17)	0	-	0	-	1	7.7	1	1
Hagerstown Community College (n = 42)	0	-	6	20.0	6	20.0	0	-
Harford Community College (n = 77)	3	10.3	15	51.7	5	17.2	0	-
Howard Community College (n = 76)	1	5.0	5	25.0	9	45.0	0	-
Montgomery College (n = 202)	14	13.1	20	18.7	15	14.0	0	-
Prince George's Community College (n = 31)	3	12.5	6	25.0	3	12.5	0	-
University of Maryland College (n = 1)	0	-	1	100.0	0	-	0	-
Wor-Wic Community College (n = 19)	1	12.5	2	25.0	0	-	0	-

Table 15. Credential(s) Earned by College

	2-year Degree		Credit Certificate		Non-Credit Certificate	
	n	%	n	%	n	%
Allegany Community College (n = 23)	20	86.7	3	13.0	-	-
Baltimore City Community College (n = 63)	0	-	0	-	62	98.4
Community College of Baltimore County (n = 25)	23	92.0	2	8.0	-	-
Frederick Community College (n = 28)	13	46.4	19	67.9	1	3.6
Garrett College (n = 13)	12	92.3	2	15.4	-	-
Hagerstown Community College (n = 30)	29	96.7	3	10.0	-	-
Harford Community College (n = 29)	16	55.2	16	55.2	-	-
Howard Community College (n = 21)	20	95.2	2	9.5	-	-
Montgomery College (n = 114)	70	61.4	15	13.1	35	30.7
Prince George's Community College (n = 26)	7	26.9	0	-	20	89.4
University of Maryland College (n = 1)	1	100.0	0	-	0	-
Wor-Wic Community College (n = 8)	5	62.5	1	12.5	2	25.0

Note: Respondents could select more than one credential.

Table 16. Industry Credential by College

	A+		CEH		CCNA		CISA		Linux+	
	n	%	n	%	n	%	n	%	n	%
Allegany Community College (n = 5)	1	20.0	0	-	0	-	0	-	0	-
Baltimore City Community College (n = 81)	21	25.9	0	-	0	-	0	-	0	-
Community College of Baltimore County (n = 20)	0	-	0	-	8	40.0	0	-	1	5.0
Frederick Community College (n = 21)	4	19.1	0	-	1	4.8	0	-	1	4.8
Garrett College (n = 5)	0	-	0	-	0	-	0	-	0	-
Hagerstown Community College (n = 9)	0	-	0	-	2	22.2	0	-	0	-
Harford Community College (n = 13)	3	23.1	0	-	0	-	0	-	0	-
Howard Community College (n = 21)	1	4.8	0	-	5	23.8	0	-	0	-
Montgomery College (n = 90)	14	15.6	1	1.11	17	18.9	2	2.2	8	10.0
Prince George's Community College (n = 9)	3	33.3	0	-	1	11.1	0	-	0	-
University of Maryland College (n = 0)	0	-	0	-	0	-	0	-	0	-
Wor-Wic Community College (n = 1)	1	100	0	-	0	-	0	-	0	-

Note: Respondents could select more than one industry credential.

Table 17. Industry Credential by College, Continued

	Network+		Security+		Other	
	n	%	n	%	n	%
Allegany Community College (n = 5)	0	-	5	100	0	-
Baltimore City Community College (n = 81)	27	33.3	9	11.1	0	-
Community College of Baltimore County (n = 20)	2	10.0	7	35.0	2	10.0
Frederick Community College (n = 21)	11	52.4	8	38.1	4	19.0
Garrett College (n = 5)	2	40.0	3	60.0	2	40.0
Hagerstown Community College (n = 9)	4	44.4	4	44.4	0	-
Harford Community College (n = 13)	6	46.2	8	61.5	1	7.7
Howard Community College (n = 21)	10	47.6	5	23.8	10	47.6
Montgomery College (n = 90)	30	33.3	49	54.4	29	32.2
Prince George's Community College (n = 9)	0	-	3	33.3	2	22.2
University of Maryland College (n = 0)	0	-	0	-	0	-
Wor-Wic Community College (n = 1)	0	-	0	-	0	-

Note: Respondents could select more than one industry credential.