COLORADO
Department of Higher Education

Stackable Credential Pathways

Report on Opportunities for Credential Attainment (SB 22-192)

2024

Prepared and submitted by the Colorado Department of Higher Education (CDHE)

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Introduction

Senate Bill 22-192, titled Opportunities for Credential Attainment called on the Colorado Department of Higher Education to work collaboratively with other state agencies, institutions of higher education (IHEs), employers and other stakeholders to build 10 stackable credential pathways across five high-value, high-demand industries between 2023 and 2025.

Stackable credential pathways are defined as "...a sequence of credentials earned through various means, including through assessment of prior learning, that may be accumulated over time and move an individual along a career pathway or up a career ladder." In addition to these 10 pathways, CDHE was to also develop a framework for evaluating the quality of non-degree credentials built into the pathways.

Non-degree credentials are defined as, a postsecondary certificate, apprenticeship certificate, professional license or industry certification."

SB22-192 also provided CDHE with $1.8 million to distribute to IHEs to support student enrollment in and completion of short-term credentials in high-demand industries, as well as $450,000 in technical assistance grants to support the creation of new non-degree credentials and the infrastructure necessary for more opportunities to obtain stackable credentials.

Colorado's Quality and In-demand Non-degree Credential Evaluation Framework was published by the Colorado Workforce Development Council in October 2023. In December 2023, the first six of 10 stackable credential pathways in behavioral health, cybersecurity and education were approved by the Colorado Commission on Higher Education in consultation with the Colorado Workforce Development Council (CWDC). These six pathways and the quality framework were subsequently shared with the education committees of the Colorado General Assembly via a report. A report on the outcomes of the $1.8 million in student support was submitted to the education committees of the Colorado General Assembly in January 2024.

The four stackable credential pathways in healthcare and software development were approved by the Colorado Commission on Higher Education in early June 2024. This report shares these pathways as well as recommendations from the industry-specific stakeholder leadership teams that built these pathways. This report also provides best practices in stackable credential pathways development as a guide to others as they work to develop thoughtful pathways from non-degree credentials through next-level education and career opportunities in additional industries and sectors.

Healthcare Stackable Credential Pathways

Colorado, like many other states, is experiencing an ongoing shortage of skilled healthcare workers. This shortage is caused by many challenges and affects Colorado communities throughout the state. Most notably these challenges threaten the quality and timeliness of patient care, leading to increased health disparities. The shortage is not limited to large hospitals and healthcare companies but is affecting healthcare providers of all sizes in all areas of the state. This shortage is further exacerbated by an aging general population with an increasing demand for healthcare services and burnout experienced by many healthcare workers, especially in the wake of the COVID-19 pandemic. To improve the health and prosperity of the population, the state must increase support so that Colorado employers can hire individuals with the right skills to enter the healthcare field, and that those learners can successfully navigate an education and career pathway.

Through work directed by SB22-192, Colorado education and training providers have an opportunity to collaborate with employers and illuminate pathways that offer on- and off-ramps for learners coming into the healthcare workforce at various points in their life, their careers, and their education paths. Stakeholder feedback highlights the need to address workforce development challenges in Colorado, with a focus on recruiting and retaining talent and addressing educational bottlenecks. Colorado has an opportunity to bolster the healthcare workforce by identifying and recruiting untapped talent for healthcare jobs; specifically, talent within secondary education, direct care work, and military populations. Current statewide policy efforts aimed at addressing the healthcare workforce shortage include offering incentives for Coloradans to earn entry-level healthcare credentials and providing incentives for healthcare professionals to practice in underserved areas. Despite these efforts, the shortage remains a pressing concern for the state's healthcare system.

To address the need for a more efficient and effective healthcare education-to-workforce pipeline, CDHE is collaborating with stakeholders to identify short-term credentials that can be earned over time to build (or stack) an individual's qualifications and skills and help them advance along a pathway to a higher-level credential or a degree. This work will outline pathways from entry-level to mid-level and beyond, to highlight opportunities for economic mobility through career development and educational advancement.

Challenges in Healthcare Workforce Development

Two of Colorado's most significant challenges in developing a healthcare workforce to meet demand are related to the recruitment and retention of skilled workers and overcoming educational bottlenecks.

Recruitment, Retention, and Advancement to fill Workforce Shortages

In the aftermath of the COVID-19 pandemic, Colorado's healthcare system is facing challenges in recruiting and retaining skilled professionals at all levels. The pandemic's impact caused significant disruptions in all areas of the healthcare workforce, increasing the workload for existing healthcare workers and prompting a significant number of workers to leave the field for a host of different reasons including burnout, fear for their own health risk, retirement or opportunities in a field with fewer physical demands.

This challenge is particularly true in nursing professions. Research from Mercer identified that Colorado is projected to have a shortfall of 10,000 registered nurses and 54,000 entry-level healthcare workers by 2026. According to the 2023 Colorado Talent Pipeline Report, registered nurses had the highest number of unique job postings and annual openings of any occupation in Colorado. Projections indicate that the healthcare workforce shortage may worsen if significant action is not taken to increase the number of qualified healthcare professionals available to enter the workforce.

There are, however, barriers to expanding healthcare education programs and recruiting potential students into healthcare programs including the shortage of qualified faculty and limited availability of clinical placement sites. While recent state policy measures, such as providing funding for individuals to earn entry-level healthcare credentials and raising the minimum wage for direct care workers are steps forward, addressing the complexities faced by the healthcare industry requires strong partnerships between Colorado employers and educators to bolster the education-to-workforce pipeline in the post-pandemic landscape.

Educational Pipeline Bottlenecks

When asked about the education-to-workforce pipeline issues, Colorado postsecondary institutions cite challenges related to hiring faculty and securing clinical placement positions for work-based learning. Colorado's postsecondary education system's ability to produce the number of qualified individuals to fill the workforce needs depends on having enough faculty to instruct and oversee healthcare education programs. Stakeholder feedback indicates that faculty often leave positions either due to retirement or to a transition to clinical employment, where they can earn significantly more than in instructional roles at postsecondary institutions. Additionally, educational requirements for faculty roles may be dependent on accrediting bodies, making it challenging for clinicians interested in teaching to move into a faculty role without the necessary credentials despite having relevant work experience. Without significant attention and effort to address this issue, faculty shortages will persist, and Colorado institutions will experience a continued reduction in their capacity to educate and graduate healthcare professionals into the workforce.

In addition to the faculty shortage, a critical barrier to expanding the number of graduates in healthcare education programs is the shortage of clinical placements. These clinical placements are essential to the work-based learning component embedded in many healthcare degree programs and a requirement for licensure in many healthcare disciplines. According to the Western Interstate Commission for Higher Education 2023 Nursing Brief, "Common reasons for limited access to clinical placements were competition across disciplines, particularly for nurse practitioners and limited availability of clinical preceptors. Some postsecondary institutions may be able to provide financial resources to secure clinical spots for students, while most public colleges and universities are not positioned to utilize constrained fiscal resources in this manner resulting in increased competition for spots." While Colorado passed legislation to incentivize preceptors taking students for rural clinical placements, in the form of a tax rebate, this issue of clinical placement shortages across healthcare programs requires long-term coordination with multiple organizations including healthcare employers, institutions of higher education, and state agencies such as the Colorado State Board of Nursing within the Department of Regulatory Agencies, to identify opportunities to increase clinical placements across the state.

Opportunities in Healthcare Workforce Development

Several promising practices have been identified through the conversations and work of the CDHE healthcare stackable credentials leadership group. These emerging practices should be scaled to increase the number of healthcare workers in the state.

Current Funding and Innovative Solutions Are Creating the Foundations That Can Be Scaled to Address Shortages

Colorado's healthcare workforce is receiving substantial support through initiatives such as Care Forward Colorado and Career Advance Colorado. Care Forward Colorado, backed by $26 million from Senate Bill 22-226, offers zero-cost, short-term training programs that address shortages in high-demand healthcare roles like certified career Advance Colorado, funded under Colorado House Bill 23-1246, aims to further address the statewide workforce shortage in sectors with substantial gaps by providing financial support for tuition and fees related to training programs. This funding extends to nursing programs at the certificate and associate degree levels. As of July 2023, these initiatives have helped more than 3,000 Coloradans complete programs in emergency medical services, phlebotomy, medical assisting and other allied health fields grappling with significant shortages.

Due in part to recent increases in statewide funding initiatives, innovative solutions have been developed for the healthcare sector by employers and educational institutions alike. Flexible entry-level opportunities, where individuals can upskill while working, are becoming more prevalent. Additionally, apprenticeship programs are gaining momentum. With grant funding from the United States Department of Labor, the Colorado Healthcare Experiential Learning Pathways to Success (CO-HELPS) program partnered with the Colorado Community College System (CCCS), Colorado Department of Labor and Employment (CDLE), Colorado Workforce Development Council (CWDC) and healthcare employers to establish 5,000 healthcare apprenticeship and pre-apprenticeship programs across several healthcare occupations. Several local community colleges have joined forces with Colorado healthcare employers to establish apprenticeship programs in high-value, high-demand jobs. This collaborative effort from industry partners and institutions of higher education creates a robust system that benefits both students and the healthcare industry.

Opportunities to Engage Untapped Talent to Bolster the Healthcare Workforce

Colorado has a significant opportunity to bolster its healthcare workforce by identifying untapped potential talent in various sectors and creating structured pathways into healthcare jobs. By recognizing and valuing the skills acquired through lived and work experiences; particularly among K-12 learners, direct care workers and military personnel, the state can strategically address gaps in the workforce.

Secondary education, Health Science Career and Technical Education Programs

Stakeholders have pinpointed a common entry point into the healthcare pipeline through high school career exploration, with robust Career and Technical Education (CTE) programs supporting students in obtaining entry-level healthcare credentials. Health science CTE programs provide students with a platform to build durable skills necessary for careers in healthcare and an opportunity to network with industry professionals. These programs not only help students develop essential skills but also foster awareness of healthcare career pathways and job opportunities after high school. Despite the existence of 95 health science CTE programs in Colorado high schools, a pressing need remains to expand health science CTE programs, especially in rural areas.

Direct Care Workforce

A second entry point into the healthcare workforce pipeline involves recognizing the potential to upskill direct care workers and entry-level healthcare workers. Feedback suggests that challenges related to career and educational advancement persist beyond hourly pay. These challenges include the time, effort and cost of advancing their education, the government benefits cliff creating a disincentive for career advancement and limited awareness of career advancement opportunities. These challenges necessitate efforts to highlight pathways that lead to high-demand, high-value healthcare jobs and provide equitable access to healthcare education and training programs. Despite existing barriers to upskilling, these professionals possess valuable work experience and transferable skills that can facilitate their progression to higher-level credentials and jobs. The Bureau of Labor Statistics reported that 60,650 Coloradans were employed as direct care workers in 2021, emphasizing the opportunity to tap into this workforce. Several healthcare training programs across the state value prior healthcare work experience in their application processes, providing an incentive for entry-level healthcare workers to pursue higher-level credentials. There is a need to expand credit for prior learning opportunities for direct care workers and entry-level healthcare workers to demonstrate competencies and receive recognition in the form of course credit for the skills they have acquired through work and life experiences. Additionally, there is an opportunity for institutions of higher education and employers to create training pathways that allow these lower-income workers to continue to earn wages while they gain skills and credentials to apply towards advanced-level positions.

Military Population

Stakeholders have also identified the military population as an untapped talent pool, with training and skills aligning well with healthcare professions. Considering that military service members often receive healthcare-related training during their service, there is an opportunity to convert this training into civilian academic and licensure requirements. Various state government agencies, including the Department of Regulatory Agencies (DORA), Colorado Department of Public Health and Environment (CDPHE), CDLE and CCCS, play crucial roles in facilitating this transitional opportunity.

When a military service member transitions out of the military, there are many complex processes they will need to navigate to understand the benefits and resources available to them. One of the issues that military members report as challenging once they exit the military is finding suitable employment that allows them to utilize their military training to the fullest extent. Given the significant shortage in the healthcare workforce

and the transferability of military knowledge, skills and training to healthcare roles, it becomes imperative for Colorado to recruit military members into healthcare training programs actively. By facilitating partnerships among community colleges and military bases, providing resources and support for training programs to become military-ready (not just military-friendly), Colorado can provide clarity to military service members who are looking to transition into civilian healthcare jobs and provide them with appropriate credentials, thereby enhancing their social and economic mobility and alleviating the provider shortage. This problem of military members coming out of the military with training not accounted for by their credentials is a problem that other state agencies have realized. There is an opportunity to focus on actively recruiting military members from active duty straight into training and education programs and establishing a standardized system for identifying where credit for prior learning could be applied. Currently, this process is left up to individual schools and employers, and the healthcare stackable credentials leadership team identified that few IHEs and almost no healthcare employers do this effectively. Without focused efforts, this healthcare talent pool will continue to be significantly underutilized.

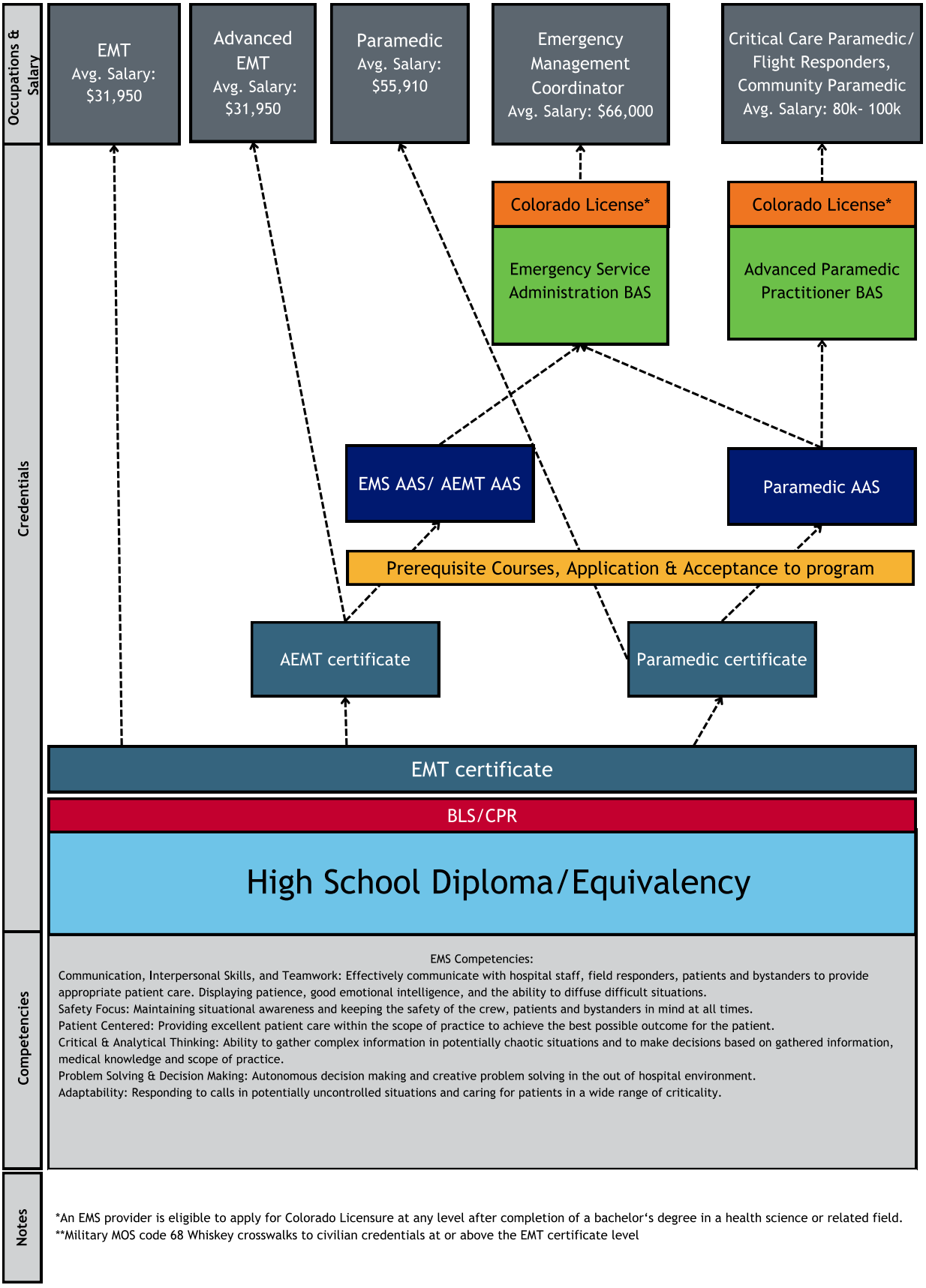
Stackable Credential Pathways in Healthcare

When CDHE surveyed the Healthcare Stackable Credentials Leadership team to understand the healthcare career pathways they wanted to address through this project, the response was that every entry-level position, whether it be administrative or clinical, offers valuable experience that could help an individual explore various healthcare career paths. This work experience also provides an excellent foundation for propelling the entry-level worker towards earning an initial credential. The leadership team also suggested that work experiences at each subsequent rung on the career ladder should be valued in a broader career pathway lattice, encompassing diverse roles such as nursing, surgical services, diagnostic services and/or emergency medical services. The leadership team viewed healthcare career advancement as dynamic, meaning that prior work experience is valuable in terms of career exploration and entry- level credentialed healthcare workers have the freedom to pivot and explore different career paths. Finally, the team noted that in practice, some entry-level credentials offer greater opportunities for “stacking” than others.

Emergency Medical Services Pathway

In the emergency medical services field, the emergency medical technician (EMT) certificate is the entry level credential. Once an individual has an EMT certificate, they can advance toward the advanced EMT certificate or paramedic certificate, both of which are non-degree credentials leading to in-demand, high-wage jobs. Both certificate options stack toward the associate of applied science (AAS) degree in their respective fields. The EMS/AEMT AAS then stacks toward the BAS (bachelor's of applied science) in emergency service administration, whereas the paramedic AAS can either stack into the BAS in emergency service administration or the advanced paramedic practitioner BAS. Once an EMS provider earns the bachelor's degree, they can apply to convert their certification to a license in Colorado. Although converting to a license does not change a practitioner’s’ scope of practice, it does acknowledge that they have completed a four-year bachelor’s degree in a health science or equivalent field. All EMS providers, certified and licensed, practice under an EMS medical director's supervision. Emergency Medical Service provider/responder education centers and groups are recognized by the Colorado Department of Public Health and Environment (CDPHE).

Emergency Medicine Pathway



Nursing Pathway

The certified nursing assistant (CNA) entry level credential is commonly regarded as the initial step towards a career in nursing. The CDHE Healthcare Stackable Credentials leadership team stakeholder feedback suggests that while the CNA certificate serves as a valuable entry point for individuals exploring careers in healthcare, its efficacy in stacking towards additional healthcare-related credentials is limited. Despite being beneficial for career exploration purposes, the CNA certification does not provide significant advantages in terms of progression towards other healthcare credentials. The nursing education and career progression stackable framework is primarily initiated from the licensed practical nurse (LPN) level. LPN is the single non-degree stackable credential in the nursing pathway prior to the associate degree level. Below is a list of program offerings within the nursing pathway, some of which are displayed in the graphic below.

- LPN to ADN: An individual can pursue LPN certificate and subsequently seek admission into an associate degree in nursing (ADN) program.

- ADN to BSN via dual enrollment: Within the ADN curriculum, there is often an opportunity for enrollment in a bachelor of science in nursing (BSN) program, allowing for dual enrollment in relevant courses.

- ADN to BSN post-RN licensure: Completion of the ADN program enables individuals to sit for the registered nurse (RN) licensure examination. Upon achieving RN licensure, candidates can advance their education by applying to a BSN program to obtain a bachelor of science degree in nursing.

- Bachelor's degree in another field to BSN: Another pathway allows individuals who have a bachelor's degree in a non-nursing discipline to earn the BSN via an accelerated program.

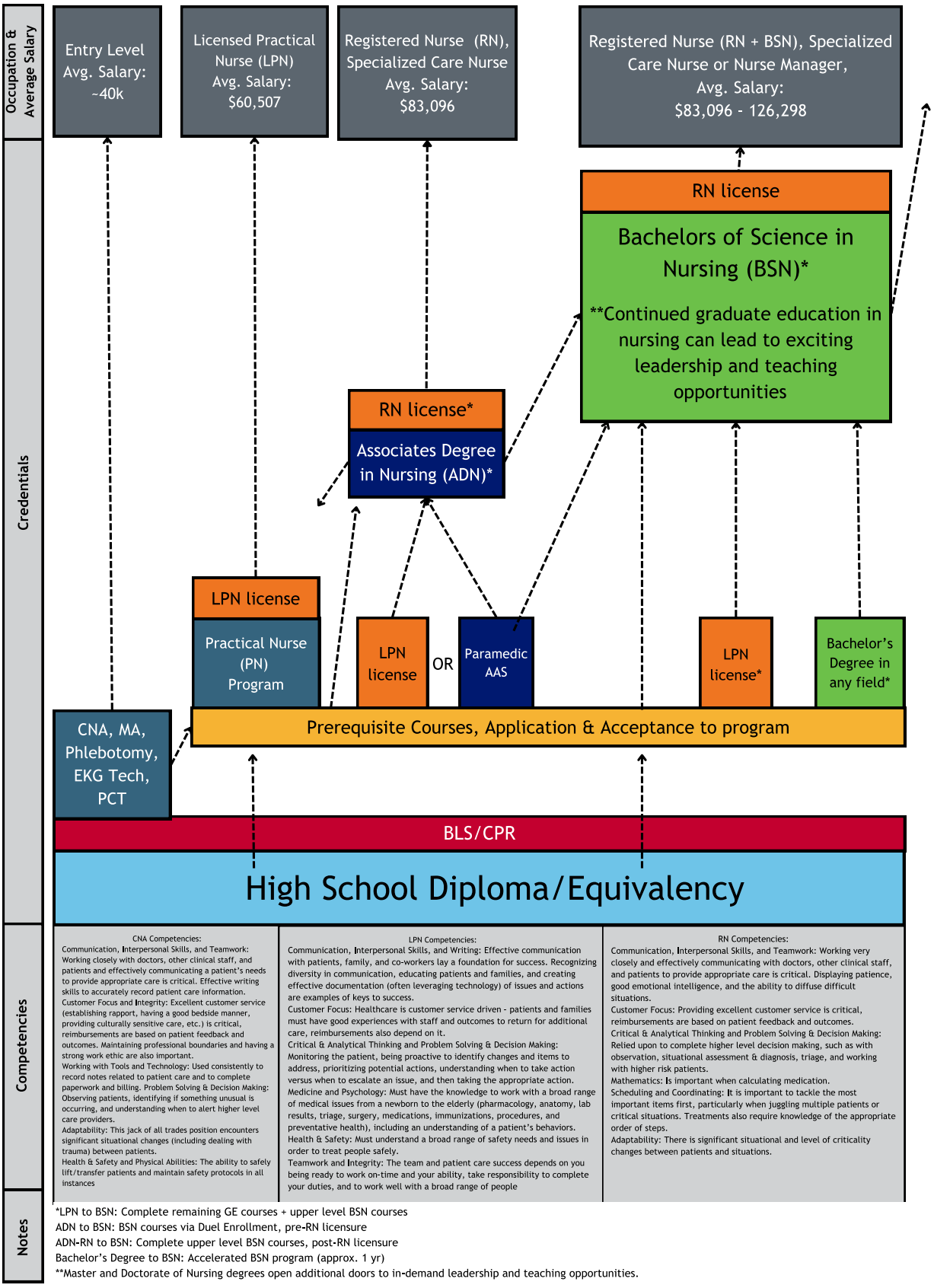
- BSN program embedded certificates: Certain BSN programs offer a unique curriculum structure which allows students to be eligible to sit for the certified nursing assistant (CNA) license after the first semester and qualify as advanced care partners upon completing the second semester. This stackable approach to nursing education and career progression offers diverse pathways catering to individuals' educational backgrounds and career aspirations.

- Paramedic to RN: A paramedic-to-ADN bridge program is an accelerated program that will allow a person to shift from a paramedic to a registered nurse. For example, at Pueblo Community College applicants who have a current Colorado paramedic license in good standing will be awarded 23 credits as prior learning credits to complete the ADN-RN degree.

- Practical nursing exit option: This option allows a student enrolled in either an ADN or BSN program to take a short summer course after the first year, then be eligible to sit for their practical nursing board exam.

Given the multiple pathways within the nursing field, the CDHE Healthcare Stackable Credentials Leadership team would advise individuals interested in this nursing pathway to talk with an academic advisor to understand all potential options for stacking credentials.

Nursing Pathway



Medical Technician/Technologist Pathway

Stakeholder feedback suggests that the medical technician and technologist occupations, such as radiologic technician/technologist, MRI technician and CT technician, are growing and in high demand occupations. These occupations require a person to hold a credential at the associate degree level prior to earning an ARRT (American Registry of Radiologic Technologists) license. In terms of this project's objectives, there are no non-degree credentials along this pathway that are stackable, prior to the associate degree. However, after a person earns an associate degree, they can earn a post-associate degree credential to expand their scope of practice and specialize in a certain area of practice. The post-associate degree professional certificate then stacks into the radiologic science BAS degree.

Preliminary Recommendations/Observations

The Healthcare Developer Stackable Credential Leadership Team and CDHE offers the following recommendations and observations to the committee:

1. **Credit for Prior Learning:** Stakeholders suggest focusing on efforts towards assessing credit for prior learning (CPL) for entry-level health professionals, such as medical assistants (MAs) and patient care technicians (PCT). This may require understanding and working with the national and state accrediting bodies for selective-entry programs (such as nursing, paramedicine, physical therapy assistants, radiology technologists, etc.) and their respective requirements. With this approach we can begin to leverage the existing skills and knowledge of individuals in the healthcare field, thereby facilitating smoother transitions and career advancements. If acknowledging the competencies acquired through these prior experiences can be established, healthcare professionals can accelerate their educational and career pathways.

2. **Academic Advising for Healthcare Pathways:** Navigating prerequisites and requirements for healthcare program applications is often a barrier for students, as each institution and program have its own requirements and curriculum. This variability underscores the critical need for faculty advisors, academic advisors and high school counselors to serve as guides, equipped with the latest information to help students interested in healthcare professions identify which specific programs they might be interested in. The advisor role extends beyond guidance; advisors are entrusted with empowering students from the early stages of their educational journey, be it in high school or college, ensuring they embark on the right academic trajectory for the individual student. Early and accessible dissemination of information becomes highly important, as the education and career landscape evolve. Academic advisors must have up-to-date

knowledge and the ability to seamlessly communicate and demystify the nuances of requirements to individuals interested in moving along a healthcare pathway. Advisors and high school counselors need to be equipped to aid students in exploring parallel pathways in healthcare or alternative career objectives if they are not accepted into selective-entry programs.

3. **Scaling Innovative Solutions and Statewide Data Collection:** There is a critical need for the development of data-driven insights into the healthcare workforce shortage. As such, the leadership team recommends that Colorado initiate a comprehensive data collection effort to understand the dynamics of the demand and supply in the healthcare workforce. First, there is a need to identify and evaluate existing innovative solutions that are successfully mitigating the workforce shortage. This evaluation process would include assessing the resources required to sustain these initiatives as well as identifying which of these solutions are ready to be scaled and what resources are needed to support bringing them to statewide scale. Assessment is needed to pinpoint specific shortage areas, reveal where additional challenges and opportunities exist, and provide clarity around when, how and who is responsible for collecting and analyzing the data. Additionally, there is a need to identify specific challenges related to clinical placements and understand the geographic distribution of clinical sites, where students fulfill the work-based learning portion of healthcare programs, as well as the post-clinical employment of graduates. While there is anecdotal information around the most significant healthcare workforce challenges through healthcare sector partnerships, a larger understanding of the scale and impact of these workforce challenges is needed to identify areas where supply is consistently lagging demand.

4. **Funding for Healthcare-Specific Reports:** The State is encouraged to consider funding to contract with accreditation bodies to provide a Colorado-specific report on nursing training slots, the number of qualified applications/applicants denied admission to nursing programs and numbers of programs facing faculty shortages. Similarly, funding is needed to develop reports with the same information for the allied health profession programs. The goal of these reports is to identify data on student interest, training and clinical placements, graduation rates, placement into healthcare workforce information and retention of these individuals in the healthcare workforce.

5. **Systematic Process for the Military Pipeline:** To facilitate a seamless transition from the military to civilian healthcare jobs, Colorado should establish systematic procedures to address the military to civilian career and education pipeline. First, it's important to understand the number of service members who are transitioning out of the military and are available for recruitment into healthcare jobs in the state. This would involve an assessment to identify the number of service members who have received healthcare

training during their time in the military, including those with ties to Colorado who may be interested in returning. Additionally, Colorado should support the development of innovative recruiting strategies that help individuals find existing best practices, such as those outlined by DORA and Pikes Peak State College and incentivize the expansion of the number of institutions of higher education and employers involved in these efforts. Lastly, the team recommends creating a standardized statewide framework, to optimize the Credit for Prior Learning (CPL) awarded for military members transitioning to civilian careers. This initiative could enhance the efficiency of the CPL process and serve as a recruitment tool within the retired military workforce pool. By implementing these recommendations, Colorado can improve pathways for service members looking to transition into civilian healthcare jobs.

Software Development Stackable Credential Pathways

Colorado is experiencing a significant shortage of software developers. The 2023 Colorado Talent Pipeline Report1 showed that software developers had the sixth highest number of unique job postings, 15,129, of any job between September 2022 and September 2023. Web developers (also known as front-end developers), web and digital interface designers, software quality assurance and testers are also occupations identified in the report as top jobs, as are several other related computer jobs.

Colorado is not alone in facing challenges related to software developer shortages. The global consulting firm Korn Ferry2 estimates that by 2030, the U.S. may lose $162 billion worth of revenue annually due to a shortage of tech talent. However, there is hope to address these shortages, with the 2022 Colorado Talent Pipeline report identifying that student interest in computer and information sciences is high, ranking second among industries of interest to college students. There is also momentum to increase interest in these jobs, with an example being that U.S. News and World Report3 rated software developers as number three on their 2024 list of Best Jobs, noting that software developers are paid well, are in-demand and often work on dynamic teams.

Challenges in Software Developer Workforce Development

The following are the top two challenges facing the software developer workforce in Colorado that were identified during the SB22-192 work.

Dynamic employer software developer needs create difficulties for traditional education approaches.

The Software Developer Stackable Credentials Leadership Team identified that the tools and approaches important for success in software developer jobs change often and vary widely between employers. An example of varying widely is that while cloud computing knowledge is a significant need in the industry, there are several different vendors (such as Amazon Web Services, Google, Microsoft, etc.) that have different tools with different training needs for this one specific subset of software developer jobs. An example of jobs changing is the impact that the use of tools that leverage Artificial Intelligence is having on the process for developing software. This increases the importance of students being prepared to learn new software

development concepts and tools on the job and researching and finding answers to questions on their own. This exemplifies how life-long and self-directed learning is an important part of being a successful software developer. The need to keep up with these changes creates significant stress on educators to keep up with these changes and brings them into the classroom, which stands in contrast to the traditional lengthy curriculum approval process and lack of funding to support curriculum change that currently exists in higher education.

Some current education approaches are out of sync with hiring and employment expectations in software development.

Employers identified that there are significant gaps in student and job seeker essential and software developer foundational skills and competencies. When asked which credentials were most important for success in a stackable career pathway, employers immediately pivoted from the need for credentials to the need to develop essential and software developer foundational skills throughout the education journey. Employers have seen too few students graduate with these skills and too many students with great potential to develop these skills never considering a career as a software developer. This same feedback was also identified by the Cybersecurity Stackable Credentials Leadership Team, which led to the two teams working together to identify the most important essential skills accompanied by recommendations for how educators and students can work together to build those skills. There is a tremendous need to incorporate the development of the essential skills within the educational system and that will work best when they are learned alongside the software developer's foundational skills.

In response to a lack of software development foundational skills in recent graduates, the leadership team developed a list of 18 concepts and practices that should be understood at a basic level by software developers as well as a range of jobs/competencies that use software developer practices. It is important for learners seeking to transition into this job to have at least an understanding of what each of these are and how they are used on a team. They should learn and use each competency in a work-like environment, utilizing one of the tools commonly in use in the industry (with an example list of those skills identified by the leadership team) prior to the completion of their training so they can become productive quickly in an entry-level job. The key is learning the competency overall and knowing how to use one tool deeply rather than learning a little bit about multiple tools that do similar things. This approach does not match the approach of many educational programs in post-secondary or higher education environments.

Each graduate should have a portfolio of software they have created on their own to show during an interview. Many educational programs don't provide the time and don't stress to students how important it is for a student to create unique software (inside or outside of a classroom) that demonstrates a student's (turned job seeker's) interest or passion, creating the opportunity to explain to a potential employer how they thought through and developed a solution for that interest. Employers also suggested that graduates create a blog that provides details around the portfolio, the creation of a LinkedIn profile and initial connections with those working in the industry (potentially through school-related programs or competitions, hackathons, or meetups).

Opportunities for Scaling Solutions in Software Developer Workforce Development

Colorado has several promising practices that have been identified because of the conversations and work of the CDHE Software Developer Stackable Credentials Leadership Team. These emerging practices should be enhanced and scaled to increase the number of software developer workers in the state.

The framework exists for the training to create graduates with the entry-level skills needed.

Stakeholders identified a common entry point into the software developer pipeline through career exploration and developing career interests in middle and high school. There are strong CTE and advanced placement programs at the state-level that support exploring software developer jobs. There are several strong CTE programs in school districts that support students to obtain one or more entry-level credentials. There are also national organizations, like SkillsUSA and Project Lead the Way, that support career development and competitions that expose students to a software developer career pathway and help to increase career interest. These types of programs should be leveraged to add the support needed to increase the number of students that obtain a credential and work in entry-level jobs using those credentials. The number of high schools that have these programs should also be expanded.

Apprenticeships effectively build the skills needed for success in entry-level IT (Information Technology) positions as well as for a transition into software developer jobs. Strong apprenticeship foundations exist, with CareerWise, CompTIA (supported by the American Institutes for Research) and eight approved apprenticeships related to software development in Colorado. Funding is also available through CO-TECH and other workforce system initiatives. Strong student interest exists in exploring a software developer career, providing a strong pipeline of potential future employees.

As mentioned above, the Software Developer Stackable Credentials Leadership Team developed several recommendations for enhancements to the education and training ecosystem to address some of the challenges that must be overcome. The overall recommended approach for how to implement these changes exists and several educators are already working to implement enhanced approaches.

Strong employment demand provides an opportunity to create a stackable pathway that meets employer needs and offers good career opportunities.

Colorado employers continue to identify both a shortage of software developers and a desire to work with educators to support students on a journey toward an entry-level software developer job. There is significant support from employers through sector partnerships, industry associations (such as the Colorado Technology Association), educational advisory committees and organizations that connect education and business (such as the Pikes Peak Business and Education Alliance). An opportunity exists for the state to leverage these significant needs and existing relationships to expand the number of opportunities for students across Colorado.

Software developer employers have a need for entry-level employees who embrace life-long learning. This is because the industry is continuously evolving, which many employers respond to by having budgets set aside to support their employees to obtain additional skills and credentials after being hired. These budgets will cover some of the funding needed to make stackable credential pathways work. However, while there are strong financial incentives for both employers and employees to advance along those pathways, a significant difficulty to overcome is a lack of entry-level jobs for those with training, but no experience, at the same time there is a shortage of software developers that have two or more years of experience.

A strong military personnel and veteran presence in Colorado provides a unique opportunity to fill many hard-to-fill software developer jobs. Many positions require security clearances, with the need for a security clearance being by far the most valued credential listed in Colorado's software developer job postings. Security clearances rank third on the list of qualifications with the largest talent gap between needs identified in active job ads versus job seeker postings with the certificate in the 2023 Colorado Talent Pipeline Report and were identified 8,000 times in Colorado software developer jobs postings over the last year. This high need provides an opportunity to recruit more military personnel who already hold security clearances into these jobs. However, most don't have software developer work experience, presenting the opportunity to connect the individuals interested in these jobs with the skill-building programs that develop the software developer skills needed for them to fill these jobs.

Finally, many entry-level jobs do not require a bachelor's degree, but instead expect the job seeker to have more focused training and credentialing. Once in a role, many employers expect the employee to continue to build skills in a lifelong learning approach to advance their career and meet their company's needs. This additional, incremental training creates the opportunity for those that don't initially have a bachelor's degree to stack their additional training and experience into associate and bachelor's degrees as their career advances.

Stackable Credential Pathways in Software Development

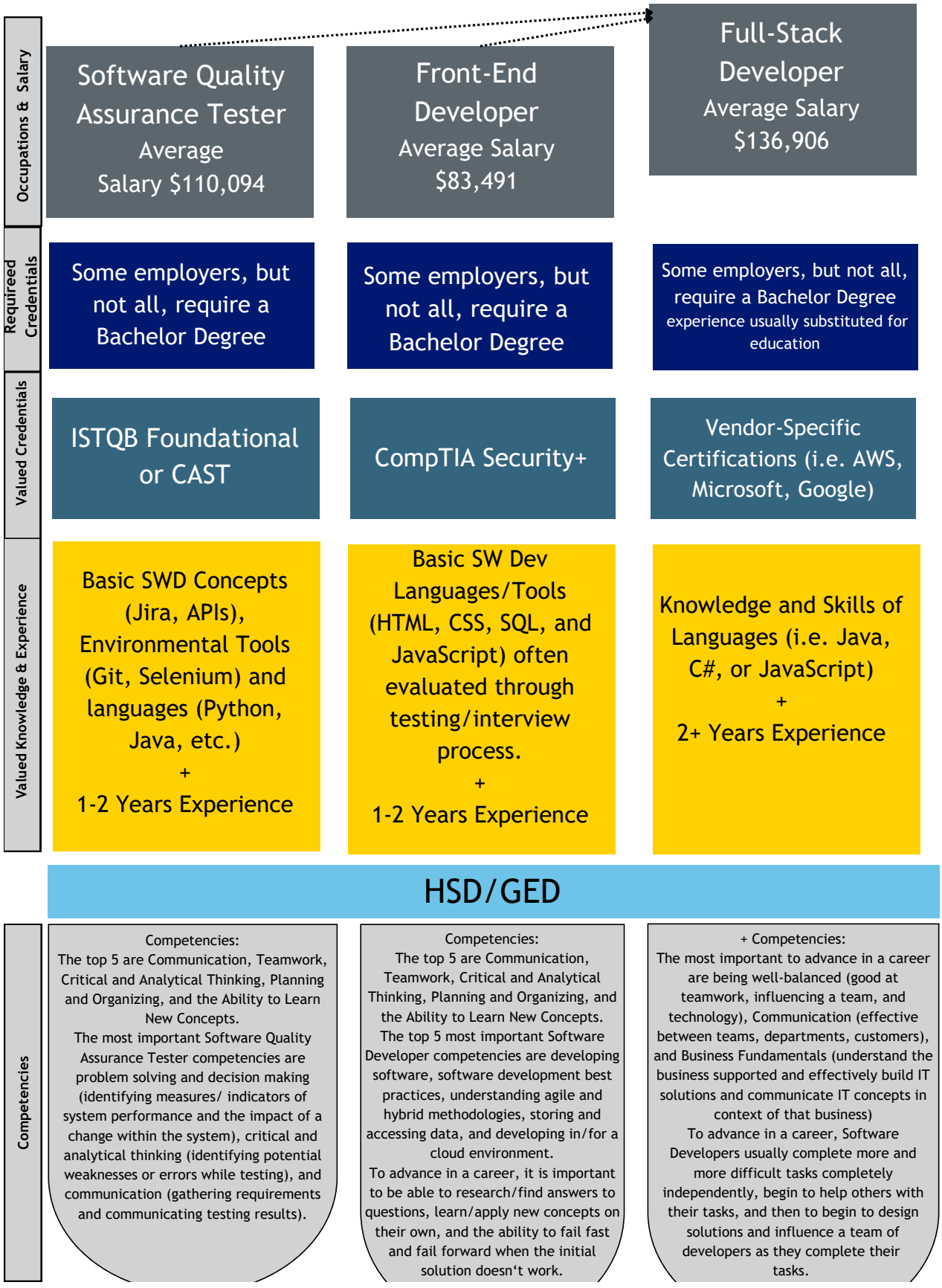
When CDHE surveyed the Software Developer Stackable Credentials Leadership Team to understand the pathways they wanted to address through this project, the response was the pathway that started at front-end developer or software quality assurance tester and then led to the in-high-demand job of full stack developer. In addition, they were interested in addressing a pathway that began as cloud developer or network administrator and led to higher-level dev ops (which is a combination of development and operations) roles. Finally, the overwhelming number of software developer job postings with security clearance requirements identified the need to build a pathway from the military to these jobs.

Full-Stack Developer Pathway

The following shows two entry-level jobs identified by employers that can lead to filling a software developer job with an employee who can build solutions in a full-stack environment (completing front-end and back-end design, development, testing, and deployment tasks).

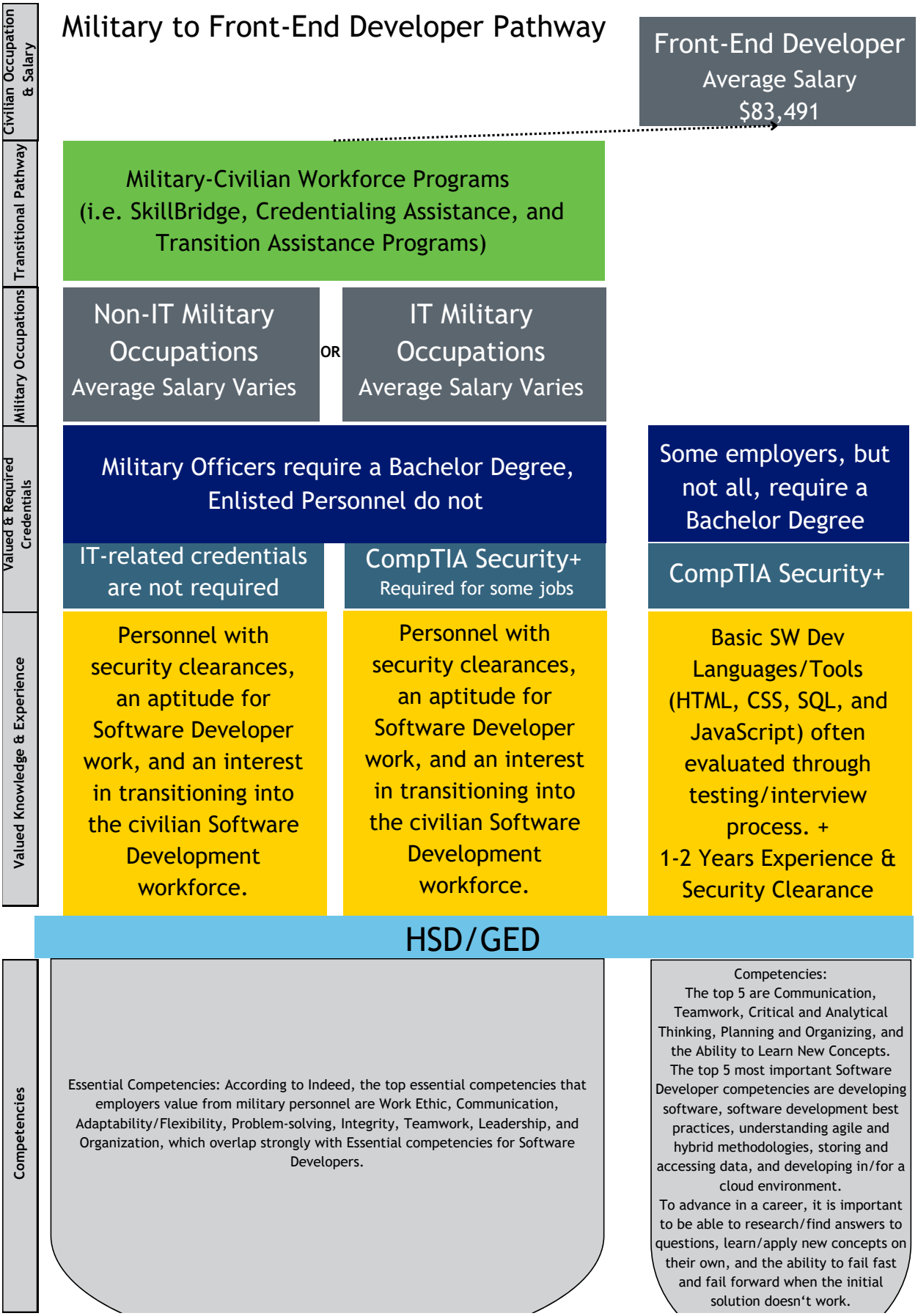
Most companies hire into mid-level roles that require some experience in an effort to find employees that can complete moderately complex tasks independently. Some companies do hire entry-level (junior) testers, front-end developers or full-stack developers at times, with most expecting them to quickly advance so they can complete moderately complex tasks independently, resulting in career advancement.

Full-Stack Developer Pathway



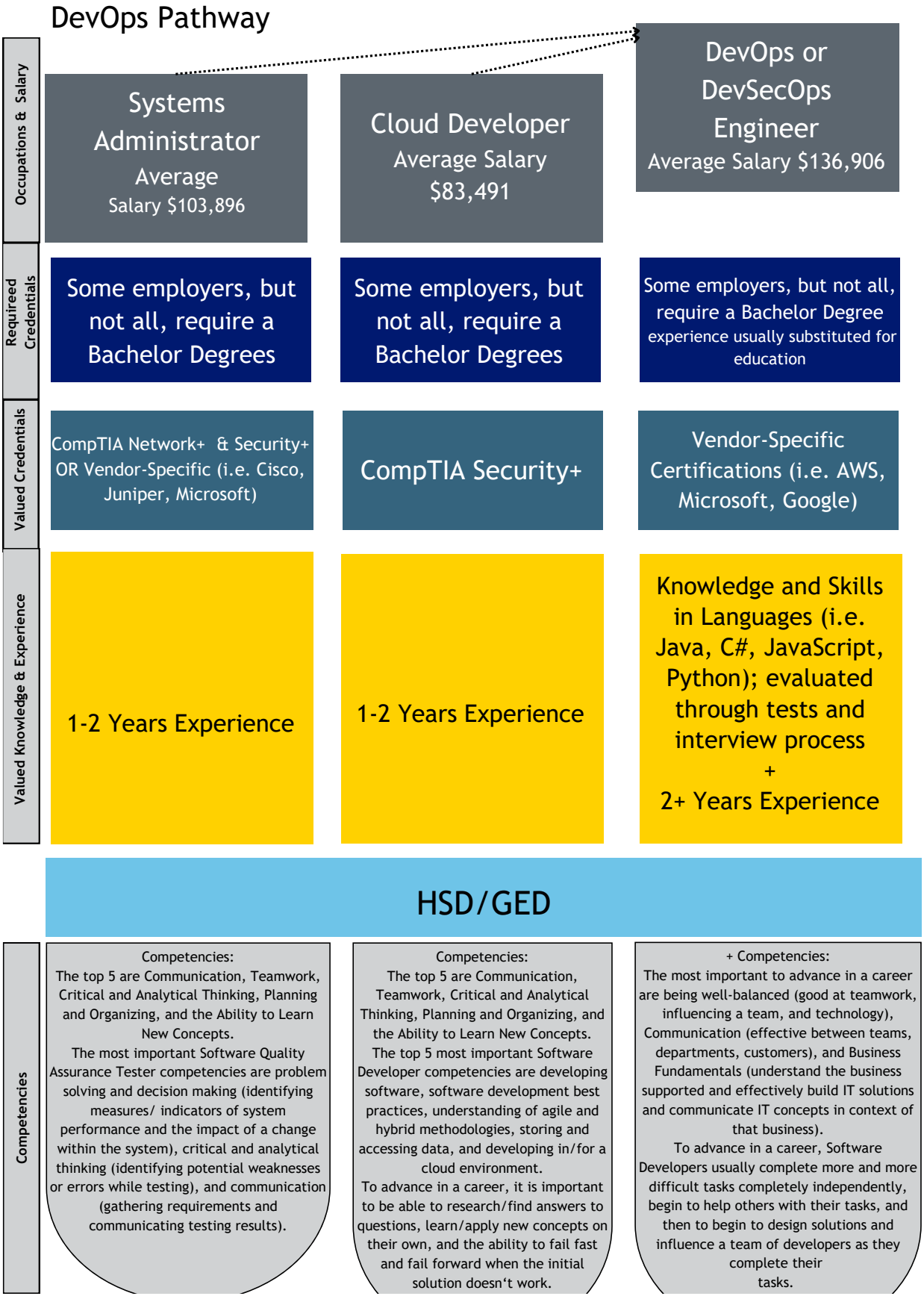
Military to Front-End Developer Pathway

The overwhelming number of references to security clearances in software development job postings identified the potential for creating a more effective pathway out of the military and into Colorado's software development jobs. Each year, there are hundreds of transitioning military personnel from Colorado bases that have information technology experience. The opportunity to enhance the pathway to Colorado's software developer jobs for those personnel is clear. However, there is additional potential to create a stackable pathway to those same jobs for personnel with security clearances, but without an IT background. A summary of both pathways is below.


Civilian Occupation & Salary
Transitional Pathway
Military Occupations
Valued & Required Credentials
Valued Knowledge & Experience
Competencies
Military to Front-End Developer Pathway
Front-End Developer
Average Salary
$83,491
Military-Civilian Workforce Programs
(i.e. SkillBridge, Credentialing Assistance, and Transition Assistance Programs)
Non-IT Military Occupations
Average Salary Varies
OR
IT Military Occupations
Average Salary Varies
Military Officers require a Bachelor Degree, Enlisted Personnel do not
Some employers, but not all, require a Bachelor Degree
IT-related credentials are not required
CompTIA Security+
Required for some jobs
CompTIA Security+
Personnel with security clearances, an aptitude for Software Developer work, and an interest in transitioning into the civilian Software Development workforce.
Personnel with security clearances, an aptitude for Software Developer work, and an interest in transitioning into the civilian Software Development workforce.
Basic SW Dev Languages/Tools (HTML, CSS, SQL, and JavaScript) often evaluated through testing/interview process. +
1-2 Years Experience & Security Clearance
HSD/GED
Essential Competencies: According to Indeed, the top essential competencies that employers value from military personnel are Work Ethic, Communication, Adaptability/Flexibility, Problem-solving, Integrity, Teamwork, Leadership, and Organization, which overlap strongly with Essential competencies for Software Developers.
Competencies:
The top 5 are Communication, Teamwork, Critical and Analytical Thinking, Planning and Organizing, and the Ability to Learn New Concepts.
The top 5 most important Software Developer competencies are developing software, software development best practices, understanding agile and hybrid methodologies, storing and accessing data, and developing in/for a cloud environment.
To advance in a career, it is important to be able to research/find answers to questions, learn/apply new concepts on their own, and the ability to fail fast and fail forward when the initial solution doesn't work.

DevOps Pathway

Finally, the Software Developer Stackable Credentials Leadership Team was interested in addressing a pathway that begins as cloud developer or network administrator and leads to higher-level DevOps or DevSecOps (which is a combination of development and operations (and sometimes security) roles. This pathway is also available to transitioning military personnel as many obtain systems administrator experience during their time in the military. A summary of both pathways is below.


DevOps Pathway
Occupations & Salary
Systems Administrator Average Salary $103,896
Cloud Developer Average Salary $83,491
DevOps or DevSecOps Engineer Average Salary $136,906
Required Credentials
Some employers, but not all, require a Bachelor Degrees
Some employers, but not all, require a Bachelor Degrees
Some employers, but not all, require a Bachelor Degree experience usually substituted for education
Valued Credentials
CompTIA Network+ & Security+ OR Vendor-Specific (i.e. Cisco, Juniper, Microsoft)
CompTIA Security+
Vendor-Specific Certifications (i.e. AWS, Microsoft, Google)
Valued Knowledge & Experience
1-2 Years Experience
1-2 Years Experience
Knowledge and Skills in Languages (i.e. Java, C#, JavaScript, Python); evaluated through tests and interview process + 2+ Years Experience
HSD/GED
Competencies
Competencies: The top 5 are Communication, Teamwork, Critical and Analytical Thinking, Planning and Organizing, and the Ability to Learn New Concepts. The most important Software Quality Assurance Tester competencies are problem solving and decision making (identifying measures/ indicators of system performance and the impact of a change within the system), critical and analytical thinking (identifying potential weaknesses or errors while testing), and communication (gathering requirements and communicating testing results).
Competencies: The top 5 are Communication, Teamwork, Critical and Analytical Thinking, Planning and Organizing, and the Ability to Learn New Concepts. The top 5 most important Software Developer competencies are developing software, software development best practices, understanding of agile and hybrid methodologies, storing and accessing data, and developing in/for a cloud environment. To advance in a career, it is important to be able to research/find answers to questions, learn/apply new concepts on their own, and the ability to fail fast and fail forward when the initial solution doesn't work.
+ Competencies: The most important to advance in a career are being well-balanced (good at teamwork, influencing a team, and technology), Communication (effective between teams, departments, customers), and Business Fundamentals (understand the business supported and effectively build IT solutions and communicate IT concepts in context of that business). To advance in a career, Software Developers usually complete more and more difficult tasks completely independently, begin to help others with their tasks, and then to begin to design solutions and influence a team of developers as they complete their tasks.

Recommendations/Observations

The Software Developer Stackable Credential Leadership Team and CDHE offers the following recommendations and observations to the committee:

1. Actions should be taken to design, support, and implement the following recommendations for educational enhancements:
    a. Incorporate the development of the IT essential competencies developed jointly by the software developer and Cybersecurity Stackable Credentials Leadership Teams and the software developer foundational competencies developed by the Software Developer Stackable Credentials Leadership Team into each software developer pathway course/program's teaching, practicing, measuring and student feedback along the journey to a credential, a degree and employment. Similar resources should also be available to students learning outside of a formal educational path.
    b. Expand the existing strong software developer CTE and advanced placement programs to additional schools.
    c. Implement a learning experience in a classroom setting that brings the essential and software developer skills together before students begin their IT career, such as a capstone experience where a student works with a team and a client (often an employer) to solve a real-world problem. Some secondary, postsecondary, and development bootcamps do this today.
    d. Support the increase of internships, registered apprenticeships and gainful employment available to students that provide credit towards obtaining a credential/degree.
    e. Provide centralized support so educators can quickly enhance their courses to reflect industry changes, including changes in the credentials and tools (such as when CompTIA upgrades its credentials) valued by industry for entry-level jobs.
    f. Have CWDC create an annual report with statewide and regional job posting information that summarizes the top credentials, education requirements and skills listed over the past year for all software developer entry-level and advanced jobs.
    g. Create training and goals for career services and school counseling staff to help students effectively prepare for applying for software developer jobs (and preferably all jobs), such as creating resumes for submission to specific job postings.

2. Actions should be taken to design, support, and implement the following recommendations to create more effective, sustainable, and affordable approaches for students and institutions:
    a. Provide the support needed for schools to support and value a stackable software developer pathway that enables entry-level education and credentialing, followed by a job using those entry-level skills,

followed by more education and credentialing and more work experience that enables the creation of a significantly expanded number of full stack developers, with degrees when appropriate, in Colorado.

b. The software development process is experiencing significant disruption by the emergence of the use of artificial intelligence. Employers have identified that students must be able to use these productivity enhancing solutions on the first day on the job. Educators are justifiably concerned about students cheating to develop their assignments instead of learning what is needed. It is recommended that a group of employers and educators work together to develop options for implementation. This should include recommendations for implementing these solutions in the learning environment and how to embrace the advantages and reduce the disadvantages.
c. The equipment/software, training and certifications for educators also require money and time and the cost must be addressed. For districts and IHEs that don't have the resources, centralized solutions should be developed and maintained by the state, without forcing all educators to use them if other solutions work best at the local level.
d. Expand the support needed for all students that successfully complete classes tied to software developer industry-valued credentials to obtain those credentials. This includes creating solutions to overcome the significant barrier of funding for post-secondary student credential obtainment, potentially like the Career Development Incentive Program funds available for secondary students, and for the state to leverage its purchasing power to lower vendor training and testing fees (such as by joining the Amazon Web Services Academy to receive lower prices on credential tests).

3. Provide the support needed to expand industry involvement in educational career pathway activities.
   a. Support a robust program for recruiting educators and industry experts that can support educator's new to teaching software development to address the shortage of software development educators. This would require addressing the significant differential between what software development educators earn versus what they could earn by working in the industry.
   b. Provide support in and out of the classroom for career exploration, job shadowing, courses, programs, competitions, interactions with industry associations, hackathons, capture the flag events, industry-based meetups and to attend conferences, all which will facilitate interactions with people working in the industry. These need to be available to all students across the state starting in middle school and in the workforce system so that all students and job seekers can explore if a software development career is right for them. This will require a focus on bringing these opportunities to underserved areas of the state. Those that have an interest also need to understand how to pursue that interest, leading to an increase in the number and diversity of those pursuing a software developer career.

c. Encourage greater employer adoption of skills-based job postings and hiring to communicate and value critical essential and software developer foundational skills.
d. Encourage the industry to develop, post, and hire enough entry-level jobs to enable job seekers without two years of experience to develop the initial experience needed to fill jobs that request two plus years of experience. Without an increase in entry-level jobs (the focus of this work), Colorado will continue to struggle to fill the very large number of unfilled software developer jobs that require two or more years of experience (often as full stack developers).
e. Many local, state and federal government software developer jobs (directly and through contracts) often require a bachelor's degree. Many private sectors and some government employers have removed degree requirements for these same jobs. It is recommended that bachelor's degree requirements be removed from government-related software development jobs whenever possible, instead focusing on the credentials that are important to demonstrate competence in these jobs.
f. More robust pathways should be developed for transitioning military personnel and veterans with security clearances to obtain the skills needed to fill Colorado's software developer job openings that require security clearances.

Next Steps

In the second year of working on software developer stackable credential pathways, the leadership team plans on continuing and/or initiating the following next steps:

1. Develop an initial plan for how colleges can value entry-level IT work experiences to award credit for prior learning.
2. Develop options for implementing AI-related productivity-enhancing solutions in the learning environment and how to embrace the advantages and reduce the disadvantages of these solutions.
3. Work with CWDC to incorporate the details identified by the leadership team related to software development roles and careers into My Colorado Journey.

Lessons Learned from Stackable Implementation

1. Requires broad and sustained stakeholder engagement (from employers, higher ed subject matter experts, state agency partners, K-12 representatives, intermediary organizations and learners. In response, we created three stakeholder groups: industry specific leadership, state agency leads, and a broad steering committee. It is important to identify key stakeholders and the balance of representatives from different groups. Have clear objectives, articulated expected outcomes and specific timelines with ongoing evaluation and revisions as needed.

2. Conduct landscape analyses and build from promising practice and partnerships. Utilize reports such as workforce/talent pipeline analyses, Industry publications, and labor market data. Research current local and state approaches and practices in other jurisdictions. This allowed us to identify needs and gaps and break down silos that often prevent cross-sector and cross-agency collaboration.

3. Requires creation or consensus on a specific quality non degree credential framework at an early stage in the process. This involved working to create a shared definition of quality among stakeholders and associated use cases. To determine if a credential meets quality standards and should be recognized as both quality and in-demand, a rubric is instrumental. The rubric outlines the quality credential criteria such as demand, evidence of skills, employment outcomes, and stackability. It is also important to incorporate the framework when incorporating credentials into approved training provider systems.

4. Develop a communications plan. This would include a communication toolkit for stakeholders and a schedule of opportunities to share in meetings or convenings of stakeholders. This should be ongoing.

5. Develop a plan for analyzing existing data and acquiring new data for measurement. It is important to identify what data will be collected to measure outcomes and how. Determine who are the responsible parties and data sharing agreements that exist or that should be created.

6. Plug into existing work (like our Credential as You Go initiative). This provides for efficient use of resources, and in our case, to expand a state initiative that was tied to a national movement allowing for greater impact and reach.

7. Engage in succession planning and sustainability efforts early on! As an implementation project with a timeline, end date and limited funding it was important to begin succession planning to ensure sustainability. With the associated staff term-limited it was necessary to begin involving other internal staff and outside organizations in the process to build capacity and knowledge. Keep historical records and documented processes and house them in a shared location.

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