



# Pipeline Program Case Studies

---

**Example Apprenticeship, Co-Op, and  
Training Programs to Inform Transportation  
Systems Management and Operations  
(TSMO) Recruitment Activities**

AUTHOR  
Stephanie Ivey, PhD

November 2022

# Highlights

---

- Apprenticeships and similar programs are valuable for recruiting diverse populations of potential workers to specific transportation occupations and career pathways.
- Apprenticeship, co-op/internship, and other training programs can be customized to address recruitment across the pipeline (K-12 to college and those transitioning from other careers) and for both paraprofessional and professional tracks.
- Successful programs require careful planning regarding recruitment, special supports for target populations, partnerships, and hiring pathways.

## IN THESE CASE STUDIES YOU WILL LEARN:

1. About a wide range of training program models that could be adapted to support creation of sustainable TSMO workforce pipelines.
2. About examples of successful transportation-oriented workforce pipeline programs that have been built by state DOTs and their partners.

# Introduction

---

Development of the transportation systems management and operations (TSMO) workforce is challenged by lack of awareness and direct academic pathways leading to TSMO careers. Interventions are needed that not only prepare potential pipelines of workers with relevant skills but also increase understanding of a range of TSMO career pathways. Apprenticeships, internships, co-ops, and other training programs have proven successful in expanding the talent pipeline for state DOTs in other workforce areas – particularly highway construction. This paper highlights the differences between pre-apprenticeships, apprenticeships, and internship/co-op experiences, potential impact that can result from successful program implementation, and several case studies that demonstrate best practices and practical considerations for developing TSMO-specific programs.

# Training Program Models

---

There are numerous models for developing training programs that recruit and develop talent for in-demand industries. Pre-apprenticeships, apprenticeships, co-ops, internships, and broader training initiatives are all designed to increase interest, awareness, and preparation for specific career pathways. However, each has a specific structure that may make it more or less suitable for a particular situation and population. The sections below outline these types of training programs and identify specific model characteristics as well as documented impacts that may influence a DOT's decision regarding the type of program to pursue for a specific TSMO application.

## PRE-APPRENTICESHIPS AND APPRENTICESHIPS

Apprenticeship and pre-apprenticeship programs championed by the U.S. Department of Labor (USDOL) have seen a resurgence in interest from employers in the last several years. Traditionally thought of for developing talent related to craft and trade workers, USDOL has expanded the scope of apprenticeships well beyond these areas to demonstrate the potential for these programs to be successful in developing talent in in-demand high-tech industry sectors such as engineering, computer science, and information technology. Additionally, USDOL has relaxed its definition of apprenticeship in recent years to include more flexible models beyond the registered apprenticeship and has also expanded its scope to include pre-apprenticeships as well.

### Pre-Apprenticeship Programs

Pre-apprenticeship programs have gained popularity for both bridging skill or knowledge gaps of candidates prior to acceptance into a regular apprenticeship program or providing an introductory experience to determine candidates most interested in progressing to a Registered Apprenticeship Program (RAP) or Industry Recognized Apprenticeship Program (IRAP). Pre-apprenticeships not only increase the likelihood of success for candidates progressing to RAPs or IRAPs but also increase retention (and thus reduce lost investment from employers for apprentices who fail to complete a program) [5]. Pre-apprenticeships are characterized by reliance on industry-based training, facilitation of progression to RAP/IRAP opportunities, provision of supportive services that enable participants to engage in and complete the program, and the ability to significantly increase diversity of candidates for RAP/IRAPs [5]. Pre-apprenticeship programs can be designed to target youth (typically high school students), post-secondary students, workers in other occupations, veterans, and disadvantaged groups. Pre-apprenticeship programs are led by a variety of organization types, frequently high schools, or community colleges.

### Apprenticeship Programs

The traditional Registered Apprenticeship Programs (RAPs) are characterized by **industry-led models that are approved by the USDOL or a state apprenticeship organization to meet a specific set of industry standards, lead to nationally recognized credentials, and prepare apprentices through both classroom education and work-based learning environments**. The key aspect of an apprenticeship program is the combination of classroom instruction and paid work experiences that integrate structured on-the-job training. Registered apprenticeship programs must also include mentorship and pathways for advancement once particular skillsets are mastered or credentials attained. RAPs will follow a well-aligned classroom and work-based learning schedule, with a specific time frame for completion (although program lengths vary by industry/occupation). The USDOL has studied registered apprenticeship

models extensively and has documented that apprenticeship programs allow employers an opportunity to develop talent through a program where organizational culture is also embedded, determine which apprentices may be best suited for long-term employment with the organization, increase productivity, and improve profitability [1]. USDOL data also indicates that more than 90% of apprentices retain employment with the employing company or organization following the completion of the apprenticeship program. Apprenticeship programs reduce turnover (4% as compared to 13% in one case study) [2] and also provide an avenue for increasing equity and diversity, although programs must be intentionally designed to do so [3]. For increasing equity and diversity, programs must be designed to recruit broader populations through demonstrating diversity in recruiting materials, using competency-based approaches for selecting candidates, include flexible design and supports for diverse groups, develop partnerships that support inclusive practices, and carefully train mentors to be inclusive in their approach and ensure they value diversity [3]. Apprenticeships can also help apprentices develop career identity, which is especially important for populations traditionally underrepresented in an industry. Registered apprenticeship programs can only be offered by approved apprenticeship providers and must strictly adhere to required USDOL documentation and tracking requirements.

Industry Recognized Apprenticeships (IRAPs), on the other hand, do not require the same level of structure and documentation as a RAP, as they are not vetted by USDOL. However, IRAPs are still high-quality programs that include both educational and work-based components and result in industry-recognized credentials. IRAPs are typically developed by trade or industry organizations, employers, institutes of higher education, or labor-management organizations. To officially be considered an IRAP, there are ten requirements that must be met, including providing a paid work experience, a written training plan and apprenticeship agreement, training leading to specialized skills, a safe working environment, commitment to providing equal employment opportunity, mentorship, credit for prior knowledge and experience, and transparency regarding any costs or fees that must be paid by the apprentices [4]. IRAPs are often preferred by employers as there are less rigorous documentation and tracking requirements than that of a registered apprenticeship program.

The programs described here are part of the official USDOL structure and recognized program types, although similar programs are frequently designed that do not go through the vetting process described above.

## **CO-OPS AND INTERNSHIPS**

Internships and co-op programs are another model for developing a pipeline of potential workers. These programs are less rigorous in terms of the requirements for developing/hosting, as they are typically designed by employers or institutes of higher education and do not require vetting through a national entity (such as USDOL). These programs also do not typically lead to a participant earning an industry credential and are not typically aligned with classroom education as with apprenticeships. However, both internships and co-ops provide students with valuable work-based, experiential learning opportunities. Both internship and co-op programs are traditionally designed for career pathways where post-secondary education is required.

Co-ops are typically arranged in partnership between an employer and an institute of higher education and feature full-time (generally paid) work experiences for a full semester or longer. Co-ops are also typically required within an educational program (or at least provide a mechanism for students to earn credit

towards their degree program). Greater collaboration and more formal structure are typically found with co-op versus internship experiences, and work experiences are typically arranged after a student has completed a certain set of core courses within their major [6].

Internships may be paid or unpaid and may take nearly any form in terms of hours offered to the student and length of time for the internship. Internships are typically the most flexible type of program for students, with employers generally working around students' class schedules in setting hours/expectations [7]. The level of structure of an internship program is up to the employer. Some employers have very well-developed practices, including formalized mentoring programs and cohort models, while others view internships as more of a part-time employee arrangement [7]. Some internships are also developed in conjunction with higher education partners and allow students to earn credit towards their degree upon completion.

Internship and co-op programs provide similar benefits to both participants and employers, although the level of success largely depends upon the individual design and implementation. Well-developed programs can lead to full-time employment and reduced turnover, greater productivity (as when student transitions to full-time employment, less onboarding is required), and increased career identity [7-8]. For these benefits to be realized, however, programs must be thoughtfully designed and expectations of students, employers, and partnering educational entities must be well aligned [7].

## **BROAD TRAINING INITIATIVES**

Another approach to increasing workforce pipelines includes training initiatives that are open to a broader population (or even freely accessible). Such programs can be designed to develop career awareness, interest, and basic competencies, and can also lead to industry credentials. Programs may target specific groups, such as high school students, or may be open to anyone who is interested in learning more about a particular career. These programs are typically designed as online, open-access training but may also be presented in workshop or career day formats. Without direct interaction between program developers/champions and participants, outcomes may be less impressive than described for more formal, personalized programs such as apprenticeships, internships, and co-op experiences. However, with strategic outreach, communication, and tracking, significant (and far-reaching) impact can be achieved.

# Case Studies: Successful Programs

---

There are many examples of successful programs for building robust pipelines into a variety of career pathways. The examples below have been demonstrated to work well for state DOTs or for TSMO-related occupations. For each case study described in this paper, the program goals, target population, model components, program outcomes, and partnerships are described. To develop a TSMO pipeline, these models can be replicated and adapted to specific content/needs.

## **OHIO LOCAL TRANSPORTATION ASSISTANCE PROGRAM (LTAP)**

### **Construction Inspection Workforce Program (CIWP)**

*Goal/mission:* “To create a workforce of job-ready entry level consultant construction inspectors- the next generation of highway & bridge construction inspectors.”

*Partnerships:* Ohio DOT (ODOT), ACEC Ohio, Columbus State Community College, Stark State College

*Target population:* Community college students: Associate’s degree programs in Civil Engineering, Surveying, and Construction Management

*Program Model:* The CIWP program includes three primary components: college coursework, certifications, and formal internships with ODOT. There are 38 credit hours of relevant coursework in the participating degree programs. Students earn National Institute for Certification in Engineering Technologies (NICET) Highway Construction Levels I & II. They also have the opportunity to earn certifications from the American Concrete Institute Level I – Concrete Field-Testing Technician, Grade 1 and learn to conduct tests for flexible pavement as well as traffic work zone safety content. Participating students also complete a year-long internship with ODOT where they are engaged in relevant projects. Upon completion of the program, students are eligible for full-time employment as construction inspectors with ODOT earning \$46,000 in starting annual pay. They are also more than halfway through course requirements for an Associate’s degree with participating colleges.

*Outcomes:* The program has been successful in attracting students to earn certifications and subsequent employment. It has also been very successful in attracting and preparing diverse students for construction inspection careers. The Ohio LTAP is now focused on developing additional e-learning modules designed to attract the public to construction trades.

*Best practices:* The program originally included partnership with a single community college. ODOT expanded the program through partnership with the LTAP center (internal to ODOT), to include an additional community college partnership. A key factor in the success of this program is having a champion to visit with students and encourage them to consider the CIWP program. The program partnerships are very important for addressing diversity goals – both community college programs participating in CIWP serve a predominantly economically disadvantaged student body and a large number of students of color.

*For More Information:* <https://www.transportation.ohio.gov/working/training/ciwp>

### **Unmanned Aerial Systems (UAS) eLearning Courses**

*Goal/mission:* “To create a workforce of job-ready entry level consultant construction inspectors- the next generation of highway & bridge construction inspectors.”

*Partnerships:* Ohio DOT - LTAP, On the Job Training (OJT) Program and UAS Center (part of Drive Ohio)

*Target population:* ODOT staff, public agencies (especially bridge inspectors), technical schools and universities, high school programs, general public

*Program Model:* The Ohio LTAP developed a series of e-learning modules that are freely accessible (outside the DOT firewall) for training a wide range of learners in skills related to UAS. The training is free and can lead to attaining a UAS pilot license. The LTAP developed the modules (UAS Awareness, UAS Remote Pilot Certification, UAS Teams Training, UAS Train the Trainer) in response to significant demand for UAS pilots and lack of understanding of how to obtain a license. Other available information at the time focused on compliance rather than training. The UAS Awareness course is designed as a foundational course to introduce learners to key UAS concepts. The UAS Remote Pilot Certification Training is a 4-part series that provides learners with all the training needed to prepare for commercial UAS Remote Pilot License exam. The Teams Training module covers requirements related to team operations, while the Train-the-Trainer modules prepares instructors to deliver the Teams Training course. Two additional modules focused on type of use and type of equipment for UAS use cases are under development and expected to be released in fall 2022. For high school students, the UAS modules are integrated into existing courses (such as STEM/robotics within Career and Technical Education (CTE) programs).

*Outcomes:* Over 4,000 people have completed pilot licensing from the ODOT program since its inception.

*Best practices:* This program has been very successful in addressing a gap in knowledge and training related to UAS. The key to its success was provide modules for free and ensuring widespread dissemination of the program’s availability. Strong partnerships within ODOT that engaged communications staff who created a comprehensive marketing plan were essential. The partnership between LTAP and ODOT’s OJT program leveraged federal funds to create the modules. The program has been very successful in preparing underrepresented minorities and people from disadvantaged backgrounds because of the ease of access and the removal of cost as a barrier to obtaining training and licensing.

*For More Information:* <https://www.transportation.ohio.gov/programs/ltap/elearning/uas>

## **DOT INTERNSHIPS FOR NEURODIVERSE STUDENTS (LOUISIANA DOT)**

### **State as Model Employer (SAME)**

*Goal/mission:* The SAME initiative, started by the Governor, provided training and awareness related to disabilities for state agency staff and required that a plan be developed and implemented to recruit and retain individuals with disabilities. This led to several key partnerships and an internship program designed to provide neurodiverse students with internship opportunities with the Louisiana Department of Transportation & Development (DOTD).

*Target population:* Students with disabilities

*Partnerships:* Baton Rouge Community College, Louisiana Rehabilitation Services

*Program Model:* The Louisiana DOTD developed a partnership with the Baton Rouge Community College's (BRCC) Program for Successful Employment. The BRCC program provides a 2-year vocational (both academic and job skills) training experience for students with autism or other cognitive differences. BRCC staff also provide training to DOT hiring managers on working with special populations. BRCC places students in internship positions based upon students' skill and areas of interest and how well these align with job focus and functions.

*Outcomes:* The SAME initiative has improved diversity outcomes for the DOTD. The program was piloted in 2020 with two interns from BRCC. The students received internship placements in Public Information/Customer Service and Enterprise Support Services sections within DOTD. One student subsequently applied to become a full-time staff member with the DOTD. The program was deemed a success by DOTD staff and is being continued.

*For More Information:*

BRCC Program for Successful Employment: <https://www.mybrcc.edu/pse/>

Louisiana DOTD SAME Strategic Plan: <https://bit.ly/3d0txcy>

## **GREATER MEMPHIS APPRENTICESHIP PATHWAY**

### **Engineering Apprenticeship Program**

*Goal/mission:* The Southwest Tennessee Community College (SWTCC) and the University of Memphis (UofM) established the Greater Memphis Apprenticeship Pathway (GMAP) program through grant funding from the U.S. Department of Labor and in partnership with industry partners that include the Greater Memphis IT Council (GMITC) and the Intelligent Transportation Society of Tennessee to provide services to 800 apprentices in high tech, IT, engineering, and computer-related occupations from 2020-2024. The intent of GMAP is to develop innovative, flexible, and replicable models for high-tech apprenticeship pathways throughout Tennessee. The UofM is focusing specifically on developing an Engineering Apprenticeship Program that immerses students in specialized training and work-based learning opportunities related to information technology, intelligent transportation systems, and other advanced technologies. Skillsets in these areas are increasing in demand for engineering graduates as technology continues to evolve and transform the way work is done in every industry segment. The goal is for students to develop cross-disciplinary knowledge and skills that will increase awareness of career pathways and prepare them for diverse career opportunities.

*Target population:* Engineering students (civil, mechanical, electrical, computer, engineering technology) at the UofM in their junior or senior year of study.

*Partnerships:* University of Memphis, Southwest TN Community College, U.S. Department of Labor, ITS Tennessee, Greater Memphis IT Council, WSP, SSR, MLGW, IMC Companies, IT/engineering industry employers

*Program Model:* The engineering apprenticeship program includes:

- An introductory workshop on transformative technologies



- Successful completion of the Transformative Technologies in Engineering course, designed in partnership with industry, the course highlights applications of innovative technologies in a wide range of applications and includes more than 15 industry partners as speakers, field trip hosts, and project mentors each semester. The course requires students to participate in a team-based innovation project, and for transportation students in the spring semester each year the project is tied to the National Operations Center of Excellence Transportation Technology Tournament.
- A 140-hour paid (minimum of \$15/hr.) work-based learning experience
- An optional advanced projects course where students are paired with an industry partner to work on a semester-long project developed by the partner.

*Outcomes:* Since the program's inception in 2020:

- 127 students have received services from the program
- 71 students have completed the Transformative Technologies in Engineering course
- 42 students have completed the work-based learning experiences as apprentices or incumbent workers
- 43 students have graduated and are in permanent engineering positions
- 91% of students indicated they are better prepared for working in industry because of the program
- 89% are more confident in their ability to network with industry professionals
- 94% are extremely likely to recommend the program to their peers

*"One of the best parts of the Transformative Technologies class was being able to learn about advances in technologies in many different disciplines. This was very interesting and way different than any other class I have taken. Being able to hear from the people who develop these technologies and established professionals was very rewarding. In my opinion the best part of this class was the apprenticeship opportunity that came along with it. Thanks to this class I was offered an apprenticeship position at WSP. I started during the summer and was able to stay on through the next two semesters, which allowed me to be offered a full-time position starting after graduation! This experience has been one of the most influential of my college career. This apprenticeship has helped grow my confidence in my abilities as a future engineer significantly. Based on my own experiences I would say the opportunities this program can offer are too rewarding to miss out on!"*

-Dylan Vatter, Civil Engineering Major, WSP Apprentice

*Best practices:* Industry engagement from inception was crucial to success of this program. Industry partners were involved from the grant writing stage through the course/program development, and as employers/speakers/mentors throughout the program. An interview with Michael Rebick, who is a core partner in GMAP through his leadership role in ITS TN and his role with WSP, indicated that ensuring that there is an individual (mentor) with time available to commit for mentoring the apprentices, having work readily available for the apprentice to engage in, and having a solid understanding of the apprentice's background and capabilities upon entering the work experience are central to creating a successful experience for both the apprentice and the employer.

*For More Information:* <https://www.memphis.edu/gmap/>

## TENNESSEE DEPARTMENT OF TRANSPORTATION (TDOT) INTERNSHIPS, CO-OPS, AND GRADUATE TRANSPORTATION ENGINEERING PROGRAM

### **Internship Program**

*Goal/mission:* TDOT's goal is to introduce college students to the importance of transportation and civil service through this internship program. The formal, coordinated version of the program began in 2015, although TDOT has hired college interns at the agency for decades.

*Target Population:* Junior or senior undergraduate students or graduate students

*Partnerships:* Universities (for recruitment)

*Program Model:* This program engages students in a full-time summer internship with pay rates starting at \$18/hr. The program provides students with hands-on project experience, professional development, networking with TDOT leadership, community outreach and social gatherings in a diverse range of positions across the state. The interns are also engaged in site visits to diverse, active TDOT projects across the state. Internships are available in civil engineering, maintenance, construction, environment, public administration, aeronautics, civil rights, and freight & logistics. Professional development includes numerous formal training sessions, including sessions on preparing for interviews and interview etiquette as well as frequent virtual lunch & learns (including one on the history of TDOT) that bring interns across the state together. Community outreach activities include volunteer work conducted as a team in each region (such as with local food banks). A capstone project is the culminating aspect of the experience. A professional development plan is prepared for each student. The hiring manager develops the plan for the student that identifies learning objectives and resources needed, outlines a plan for networking with key offices related to intern's primary role, and provides specific due dates for capstone project deliverables. Interns also prepare a set of personal learning goals, and the manager reviews this to incorporate as many relevant experiences as possible into the professional development plan. Capstones are presented at end of the summer to fellow interns, TDOT staff, and senior leadership.

*Outcomes:* In 2022, TDOT onboarded 53 interns. Eighty percent are civil engineering, but there were also interns hired from urban planning, business, environmental science, physical science, and other disciplines. TDOT has continued to hire from this pool into permanent roles across the state, with the internship program serving as a critical pipeline, particularly for engineers. TDOT maintains communications with interns after the summer experience to attract them to government service. TDOT continues to evolve the program based on feedback from interns and managers. TDOT provides the opportunity for interns to provide feedback throughout the experience through multiple surveys. HR staff also coordinate pre-planning meetings to prepare TDOT managers to serve as mentors to interns, develop the professional development plans, and ensure a robust project experience is provided.

*For More Information:* <https://www.tn.gov/tdot/human-resources-home/tdot-careers/internship-program.html>

\*A video overview of the internship program developed by an AV intern is available for viewing on the site.

### **Co-Op Program for Mechanic Positions**

*Goal/mission:* To improve applicant pools for mechanic positions, where TDOT typically sees low numbers of qualified applicants. The goal of the program is to attract highly motivated candidates

and reduce turnover.

*Target Population:* Students within Tennessee College of Applied Science (TCAT) automotive programs

*Partnerships:* TCAT – has 26 locations across the state of Tennessee, TDOT Region 3 (Nashville) Garage

*Model:* The program is open to students currently enrolled in a technical college and pursuing a degree within the automotive industry. Students must have completed at least one trimester of technical school to be eligible. Participants in the co-op program are paired with a TDOT Mechanic, who serves as a subject matter expert for diagnosing, analyzing, and repairing varied heavy-duty tracked and wheeled diesel-powered equipment. The co-op participants work with the TDOT Mechanic to obtain real-world experience and earn credit toward their degree program. Participants can work up to 1600 hours per year in the co-op placement and are paid \$18/hr.

*Outcomes:* The program has been formally approved by TDOT leadership and a memorandum of understanding established with TCAT. The pilot begins in Fall 2022 with TDOT Region 3 (Nashville, Murfreesboro and Smyrna, TN). Region 3 Garage and Human Resources staff will visit with TCAT students to recruit co-op candidates. There has been a significant amount of interest even with the program being in its beginning stages, including interest in expanding to other TDOT regions.

*For More Information:* Contact Sammy Koszalka, TDOT HR Generalist II, [samantha.koszalka@tn.gov](mailto:samantha.koszalka@tn.gov)

### **Graduate Transportation Engineering Program**

*Goal/mission:* To provide entry level civil engineers with professional development in the core areas essential to TDOT's mission. The program is designed to help Graduate Transportation Engineers (GTEs) learn about the project development process from start to finish through a collaborative team approach.

*Target population:* civil engineering graduates, 10-20 per cohort

*Partnerships:* University partners to attract graduates to the GTE program; Internal working groups to develop curricular objectives within each discipline. Engineers from across TDOT helped develop what program should include, what core disciplines should be, and what elective areas to offer. Additionally, a consultant, Rawlins Consulting Group, helps to manage and oversee development of curriculums for the program focus areas.

*Program Model:* The GTE program builds from a 2-year rotation program that trained more than 450 entry level civil engineers since the program's revamp in 2013. The original program provided new hires with hands-on experience in one disciplinary focus area. The new program provides a 2-year rotation to GTEs, is curriculum based, and focused on hands-on training. During the first year of the rotation, the core areas of focus are: Geodetics, Construction, Roadway Design, and Traffic Design & Operations. GTEs choose electives in the second year (current options include: Materials & Tests, Structures, Aviation, and Maintenance). Throughout the program, GTEs learn about the project life cycle and the role each of the TDOT Divisions and disciplinary areas play. Within the curriculum for each core program area, learning objectives that should be accomplished are specified as well as level of proficiency (introductory, working knowledge, demonstrated competency). The GTE is responsible for tracking progress towards learning objectives and supervisor(s) also provide feedback/sign off on mastery of knowledge/

skills at appropriate level. The 2-year experience provides GTEs the opportunity to learn what they enjoy, to understand where they may best fit, and to build relationships across the agency. At end of 2-year program, GTEs are encouraged to pursue open positions in the location/division of most interest to them that best fits their strengths. Supervisors also provide guidance to GTEs in this process. GTEs must have graduated with a BS in Civil Engineering from a 4-year, accredited institution to be eligible and must pass the FE within 11 months of starting employment with TDOT to be retained in the program.

*Outcomes:* A cohort of 11 GTEs is currently in the program, with a new cohort being recruited for summer 2023. Many former GTAs have had the opportunity to advance into leadership roles at TDOT as supervisors, Assistant Directors, and Directors. TDOT expects to open the program beyond the civil engineering focus in future years.

*For More Information:* <https://www.tn.gov/tdot/human-resources-home/graduate-transportation-associate-program.html>

## Summary

---

To address TSMO workforce challenges, strategic development of the talent pipeline is crucial. This includes considering a comprehensive approach designed to increase awareness, interest, and preparation for varied career paths among secondary, post-secondary, and other adult populations. Additionally, intentional partnerships with organizations supporting diverse individuals can significantly enhance the diversity of talent pools, creating new avenues that bring previously untapped talent into the workforce. Agencies must be both strategic and creative to develop programming that is effective for addressing workforce development goals, particularly when considering both paraprofessional and professional pipelines. While many of the successful programs and practices presented in this paper are directed at a broader agency agenda beyond a strict concentration on TSMO, the strategies and program models highlighted are valuable for creating a workforce development approach for TSMO.

# References

---

1. U.S. Department of Labor. (2022). ApprenticeshipUSA: Explore Registered Apprenticeship. Accessible online: <https://www.apprenticeship.gov/sites/default/files/dol-industry-factsheet-apprenticeship101-v10.pdf>
2. Economics and Statistics Administration, Office of the Chief Economist (2016). The Benefits and Costs of Apprenticeships: A Business Perspective. Accessible online: <https://www.commerce.gov/sites/default/files/migrated/reports/the-benefits-and-costs-of-apprenticeships-a-business-perspective.pdf>
3. Gretchen Cheney. (2019). Growing Equity and Diversity through Apprenticeship. Center for Apprenticeship and Work-based Learning. Jobs for the Future. Accessible online: <https://jfforg-prod-new.s3.amazonaws.com/media/documents/GrowingEquityandDiversitythroughApprenticeship-BizPerspectives-07182019-2.pdf>
4. U.S. Department of Labor, Office of Apprenticeship. (2022). Industry Recognized Apprenticeship (IRAP) Sponsor Fact Sheet. Accessible online: <https://www.apprenticeship.gov/employers/industry-recognized-apprenticeship-program>
5. U.S. Department of Labor. (2022). Explore Pre-Apprenticeship. Accessible online: <https://www.apprenticeship.gov/employers/explore-pre-apprenticeship>
6. Earnes, C. and Coll, R. (2010). Cooperative Education: Integrating Classroom and Workplace Learning. In: Billett, S. (eds) Learning Through Practice. Professional and Practice-based Learning, vol 1. Springer, Dordrecht. [https://doi.org/10.1007/978-90-481-3939-2\\_10](https://doi.org/10.1007/978-90-481-3939-2_10)
7. Maertz Jr., P., Stoeberl, C., and Marks, J. (2014), "Building successful internships: lessons from the research for interns, schools, and employers", Career Development International, Vol. 19 No. 1, pp. 123-142. <https://doi.org/10.1108/CDI-03-2013-0025>
8. Kate J. Stringer & Jennifer L. Kerpelman (2010) Career Identity Development in College Students: Decision Making, Parental Support, and Work Experience, Identity, 10:3, 181-200, DOI: [10.1080/15283488.2010.496102](https://doi.org/10.1080/15283488.2010.496102)