

**Building Apprenticeship Systems for Middle-Skill Employment: Comparative Lessons
in Innovation and Sector-Based Strategies for Apprenticeships**

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Prepared for National Academies Board on Science, Technology, and Economic Policy
The Supply Chain for Middle-Jobs: Education, Training, and Certification Pathways

Introduction

Interest in apprenticeship models offered in many other G20 countries has surfaced and resurfaced again in the United States as policy-makers and educators attempt to fix multiple, simultaneous problems: a) a creeping youth unemployment crisis, particularly among otherwise socially disadvantaged young people; b) a persistent complaint from employers as to the skills mismatch of available employees; and c) a dragging high school and college completion rate that suggests a systemic problem with the current linear path that is prescribed to students early in their education.

In May 2012, the G20 labor and Employment Ministers concluded that countries should:

“...Promote, and where necessary, strengthen quality apprenticeship system...” with an aim to fostering the “...sharing of experience in the design and implementation of apprenticeship programs and exploring ways to identify common principles across G20 countries by facilitating a dialogue among our social partners who have presented us a shared sense of the importance of apprenticeships.”¹

This conclusion, aided by the B20 Task Force, which called for the scaling up of quality apprenticeships for young people-including a cross-G20 apprenticeship scheme-suggests an appetite for understanding both how apprenticeships may help to address the aforementioned challenges and how cross-national learning may positively impact the outcomes for apprenticeship design and implementation.

Apprenticeship offers a learn-and-earn model that fundamentally eases the transition from school to work. An apprenticeship model which situates a student in a firm as an *employee* fundamentally shifts the nature of learning that takes place. Apprenticeships provide not only technical skill creation, but also foster the learning of “21st Century Skills”, those skills that are fundamental to the workplace. Many G20 countries, particularly

¹ G20 Labor and Employment Minister Conclusions, May 2012.

Germany, Austria, Denmark, and Switzerland, have had tremendous success with apprenticeship training as a mechanism to address the issues of youth unemployment and a mismatch of skills between employers and employees. Other countries with less established apprenticeship systems, such as the UK, which increased their number of apprentices by ten times between 1990 and 2010, have indicated a focus on increased participation of apprenticeships as a percentage of the labor force. The apprenticeship systems in these countries share a number of characteristics that have the potential for replication, which has driven the renewed interest in the potential for exportation to other countries.

There are distinct challenges with translating systems from one context to another. The history of apprenticeship in the United States indicate an inconsistent interest in developing and funding a systemic approach towards the development of an apprenticeship system. This inconsistency has led to significant barriers to the expansion of apprenticeship in the United States (such as a lack of information about apprenticeships, employer misperceptions about union participation, inconsistency in the public funding between college courses and apprenticeship programs, an extremely small Department of Labor Office of Apprenticeship budget, and a lack of cohesive apprenticeship tracking and categorization).²

The development and implementation of programs across the United States, such as the Kentucky Fame model, the Georgia Youth Apprenticeship Program, MAT2 in Michigan, Apprenticeship Carolina, and others however show a real appetite for creating apprenticeship programs that borrow certain characteristics of successful apprenticeship systems elsewhere. In particular, there is a renewed interest in the development of apprenticeship systems aimed

² For a detailed discussion, see Lerman, Robert. 2014. "Proposal 7: Expanding Apprenticeship Opportunities in the United States." In Kearney, Melissa and Benjamin Harris, eds. *Policies to Address Poverty in America*. The Hamilton Project. And Lerman, Robert I. 2013. "Expanding Apprenticeship in the United States: Barriers and Opportunities." In *Contemporary Apprenticeship: International Perspectives on an Evolving Model of Learning*, edited by Alison Fuller and Lorna Unwin. New York: Routledge.

at middle-skill employment, which can be defined as employment that generally requires some education and training beyond high school but less than a bachelor's degree.³ For these middle-skill opportunities, education and training can come in the form of traditional (in the U.S. case) post-secondary degrees and/or certificates, but can also come in the form of military training, employer-only provided programs, or apprenticeship programs. Of interest at present is the potential for a hybrid of some of these systems, wherein the educational institution acts in partnership with the employer to provide a dual-training model of apprenticeship learning, but where the primary relationship is between the student (i.e. employee) and the employer.

This paper, commissioned by the National Academies of Sciences for the Symposium on the Supply Chain for Middle-Skill Jobs: Education, Training, and Certification Pathways, aims to constructively add to the debate about the potential for exportation of successful apprenticeship characteristics in the effort to build an apprenticeship system in the United States that provides more opportunities to “learn-and-earn” to a greater number of students. This paper explores apprenticeship in the context of youth unemployment and the challenge of skills shortage, particularly for small to medium businesses, and the challenge of skills mismatch, particularly for underserved populations. Further, it examines existing apprenticeship systems and established frameworks and address innovations that expand the possibilities for scaling apprenticeship systems, with a particular focus on sector based approaches, technology applications, and the development of consortium models that leverage and pool local employment resources. The focus in this paper is on the potential for

³ The definitions for this term are not fully agreed upon and have been termed “awkward at best”. Broad occupational groups have been grouped into high-skill, middle-skill, and low-skill categories based on BLS estimates (see Holzer and Lerman 2009); National Skills Coalition methodology classifies jobs based on the typical education and training level of the workers in those jobs; U.S. DOL’s database of occupation and occupational descriptions, O*NET, classifies jobs into five zones based on the education, experience, and training necessary to be proficient for those jobs; and ACT utilizes the percentage of jobs in a given industry that require a certain level of education, which is aligned to a score on the ACT Workkeys” (see Achieve, “The Future of the U.S. Workforce: Middle Skill Jobs and the Growing Importance of Postsecondary Education”).

expanding apprenticeship as part of the development of career pathway systems, particularly for young people, as they transition from secondary into post-secondary institutions and/or into careers. This synthesis of existing information will work to add to the development of a framework for building a successful apprenticeship system for middle-skill employment, but particularly for this age group.

Skills Mismatch: Youth Unemployment and Unfilled Positions

Youth unemployment in the United States is high relative to many of its European counterparts. Despite dropping unemployment rates in the United States, youth unemployment, which hovers between 11-13% for 16-24 year olds, remains a chronic and persistent problem. Recent difficulties for young people in the labor market aren't necessarily a new trend; "young people have long had the greatest difficulty maintaining stable employment."⁴ However, that the youth unemployment rate is three times higher than the rate for prime age workers-and is even higher for minorities and otherwise socially disadvantaged persons- has serious implications for the broader economy, as well as for young people later on. Early labor market experiences are crucial for career trajectories and future productivity growth. Research has indicated that employers want graduates with work experience; work experience and work-based learning are "strongly advocated as effective means of enhancing employability."⁵

Skills mismatch and skills shortage are often cited as key reasons for high unemployment, both among youth and adults, referring to a mismatch or absence between the skills a worker may possess and the skills required by employers. People with poor skills "face a much greater risk of experiencing economic disadvantage, and a higher likelihood of

⁴ Fiscal Times, 2015; Schmillen and Umkehrer, 2013

⁵ Moreland, 2005; Berman and Ritchie, 2006.

unemployment and dependency on social benefits.”⁶ Despite good educational attainment relative to its G20 counterparts, skills mismatch and/or shortage are considered endemic problems in the United States. A 2011 survey conducted by Deloitte Consulting of American Manufacturers demonstrated that “600,000 manufacturing jobs were unfilled because companies could not find workers with the right skills”; in 2013, at a time of historically high unemployment in the United States, 3.8 million job openings remain unfilled, while approximately 11.8 million people were unemployed.⁷

Much of the excitement around the development of apprenticeships in the United States is for their potential to alleviate skills gap or skills mismatch in middle-skill employment. The skills-gap or mismatch in middle-skill occupations creates conditions which hamper sustainable growth for businesses, but also make it difficult for workers to gain meaningful employment. A report by Chase in 2015 finds that “middle-skill jobs are at the intersection of economic growth for employers and economic opportunity for individuals who continue to struggle with unemployment and limited job prospects.”⁸

Information from the National Skills Coalition indicates that the demand for middle-skill employment is strong: 54% of all jobs in the United States in 2014 were classified as “middle-skill”, or those occupations which require more than a high-school degree, such as a certification or additional training, but do not require a bachelor’s degree. Analysis indicates that the demand for middle-skill employment will also remain strong; between 2012-2022, 49% of job openings will be middle skill. However, the gap in training to these positions is

⁶ OECD. 2012. *Better Skills, Better Jobs, Better Lives: A Strategic Approach to Skills Policies*, OECD Publishing.

⁷ Aivizova, Natalia. 2013. *Role of Apprenticeships in Combating Youth Unemployment in Europe and the United States*. Peterson Institute for International Economics. Number PB13-20.

⁸ JP Morgan Chase. *Closing the Skills Gap: Preparing New Yorkers for High-Growth, High-Demand, Middle-Skill Jobs*. New Skills at Work. <http://www.jpmorganchase.com/corporate/Corporate-Responsibility/document/54841-JPMC-GAP-REP-AW6.pdf>

also evident. While middle-skill jobs account for 54% of the United States' labor market, only approximately 44% are trained to the middle-skill level.⁹

These dynamics are relevant to the discussion on the development of apprenticeship systems in the United States precisely because it is these realities that apprenticeship programs have the potential to address. The dual problems of youth unemployment and unfilled positions due to a (either real or perceived) shortage of skills speaks to a broader disconnect between what students are learning in the classroom and what employers need. Apprenticeship systems have long been looked at as important (but in the United States, often overlooked) mechanisms to address both structural unemployment, including the persistent complaints of a skills mismatch, and to “ease the transition from full-time education to work for young people”.^{10 11}

Successful apprenticeship models offer the opportunity for students to gain crucial work experience while gaining important theoretical and transferable knowledge and certifications that are aimed at skill acquisition in an occupational field, rather than for a single company. Well-crafted apprenticeship models can provide a key vehicle for skill transfer that helps fill the experiential learning void that many students face. Employers, particularly those that have difficulty filling those key middle-skill positions, are able to develop a pipeline for a supply of labor with the necessary skills that were “otherwise difficult to find in the labor market.”¹² Well-designed apprenticeship programs allow firms to

⁹ National Skills Coalition. 2014 United States Overview. <http://www.nationalskillscoalition.org/state-policy/fact-sheets>

¹⁰ Steedman, Hilary. 2012. *Overview of Apprenticeship Systems and Issues: ILO Contribution to the G20 Task Force on Employment*. International Labor Organization.

¹¹ Aivizova. Ibid.

¹² Hasluck C, T. Hogarth et al. 2008. *The Net Benefit to Employer Investment in Training*. Institute for Employment Research, University of Warwick.

have some control over skills shortages and lower labor turnover; apprentices can also bring innovation into the workplace.¹³

Youth unemployment is an issue for all G20 countries. Many of the world's advanced economies still struggle with high levels of unemployment seven years post-economic recession. In June 2013, the European Council indicated that "youth unemployment has reached unprecedented levels in several Member states" and called for "urgent action"¹⁴ However, in countries with high proportions of young-under 25- apprentices relative to the employed population, in countries with dual-education models, such as in Austria, Germany, and Switzerland, youth unemployment is currently much lower."¹⁵ A long-standing and "robust body of evidence has consistently shown that countries with rigorous apprenticeship schemes, such as Germany, Austria, Denmark, Norway, the Netherlands, and Switzerland, are the most successful in terms of school to work transition, " largely as a result of dual-education systems and the structures that support it.¹⁶

The dual-education model, which consists of a combination of classroom education in a post-secondary program of study and a direct relationship with an employer through a multi-year apprenticeship, addresses the acquisition of skills related to employment opportunities.¹⁷ In this dual model, education and training do not take place only within a post-secondary institution, but rather this "theoretical training is accompanied by relevant practical training and experience with a partnering company, with the apprentices receiving a

¹³ Ibid.

¹⁴ European Council, *Conclusions*, June 28, 2013, cited in Aivazova, 2013. *Role of Apprenticeships in Combating Youth Unemployment in Europe and the United States*. <http://www.iiie.com/publications/pb/pb13-20.pdf>

¹⁵ Steedman, *ibid.*

¹⁶ European Commission. 2013. *Apprenticeship and Trainee Schemes in EU27: Key Success Factors. A Guidebook for Policy Planners and Practitioners*. Project website: <http://ec.europa.eu/social/youthtraining>

¹⁷ Powell, Justin and Johann Fortwengel. 2014. "Made in Germany"-Produced in America? *How Dual Vocational Training Programs Can Help Close the Skills Gap in the United States*. Issue Brief 47. American Institute for Contemporary German Studies: Johns Hopkins University.

salary as they gain work-related skills.”¹⁸ The main advantage of these systems is that the model of dual-education leads to a “close match of the skills and competencies provided as part of the vocational education and training on the one hand, and the skills needed and required for employment on the other.”¹⁹

This dual-education (or dual-study) model works well because it places the relationship between the employee (student) and the employer (workplace) first. Students apply directly to a firm, which has an agreement with an institution of higher education that provides the theoretical or academic portion of the training.²⁰ The renewed interest in developing apprenticeship models in the United States is oriented around this model, and is aligned to a broader understanding that if the world of work and the world of school are to be better connected in some way, there need to be multiple mechanisms to accomplish this.

In comparison to other advanced G20 countries, the current levels of apprenticeship in the United States are scant; apprenticeships make up only 0.2 pf the U.S. labor force.²¹ The U.S. apprenticeship system is highly decentralized, with oversight through the “Registered Apprenticeship” system under the supervision of the U.S. Labor Department’s Office of Apprenticeship (OA) and State Apprenticeship Agencies.²² Community colleges are often the organizers and facilitators of the apprenticeship programs, which means that the primary relationship is usually between the student (employee) and the community college (academic institution). This fundamental difference between the two systems is crucial; because the employer is not part of the core relationship but is part of a work-based learning component

¹⁸ Powell and Fortwengel. Ibid.

¹⁹ Nicholson, Parke and Johann Fortwengel. March 2015. *European Apprenticeship: A Model for the U.S.?* Issue Brief 49. American Institute for Contemporary German Studies: The Johns Hopkins University.

²⁰ Graf, Lukas. 2014. *Developing Advanced Work-Based Higher Education: What Germany and the U.S. Can Learn From Each Other.* American Institute for Contemporary German Studies: Johns Hopkins University.

²¹ Smith, Erica and Ros Brennan Kemmis. 2013. *Towards a model apprenticeship framework: a comparative analysis of national apprenticeship systems.* International Labor Organization and The World Bank.

²² For an excellent discussion on the nature of the U.S. Apprenticeship System, see: Lerman, Robert. 2012. *Can the United States Expand Apprenticeship? Lessons from Experience.* IZA Policy Paper No. 46. and Smith and Kemmis, *ibid.*

to their study, participation from the employers (outside of core occupations such as construction and basic manufacturing) is often minimal.

However, since 2004, the United States has pursued registration of new apprenticeship programs in high growth industries (such as Health Care, Advanced Manufacturing, Information Technology, and Biotechnology) and individual apprenticeship programs based on the hybrid model, such as Kentucky FAME, Apprenticeship Carolina, Mat2 in Michigan, and emerging models in Illinois suggest further interest in developing a model that doesn't precisely mirror the model dual-education model that German, Austria, and Switzerland are known for, but that take local context into consideration.²³ The development of these individual models is crucial as a proof-of-concept in the United States, but it is important to note that the government can also enjoy fiscal and social benefits from encouraging apprenticeships and can provide incentives to participation, management of equity issues, and overcoming general market failure.²⁴ Dual-system apprenticeship programs by their very nature are public-private initiatives; the fiscal burden to the government is reduced as a result. By easing the transition from school to work, apprenticeships offer a mechanism to reduce youth unemployment and point to a "way" or method by which the world of work and school are inherently connected. Additionally, it is worthwhile to note that in "countries with well-established apprenticeship systems, the institution of apprenticeship is

²³ In addition, various attempts at legislation surrounding apprenticeships are consistently tried. Senators Tim Scott (R-SC) and Cory Booker (D-NJ) introduced the LEAP Act (Leveraging and Energizing America's Apprenticeship Programs), which would provide a tax credit to employers to help increase the number of registered apprenticeships in the United States.

²⁴ By no means is this perspective one that encourages the "straight transplantation of institutions" from one cultural context to another without regards to the wider context of cultural traditions and aspirations of individuals, as well as the complexity of labor market regulation. These characteristics that underpin successful apprenticeship systems can illustrate value, however. (Steedman, 2012)

hardly contested between the political parties. Instead a growing cross-party consensus can be detected that apprenticeship is desirable and should be supported by public funds.”²⁵²⁶

Lessons from Mature Apprenticeship Systems

The positive evidence on the role that apprenticeships might play in reducing a skills gap issue and in creating better school to work transitions for students has again renewed interest in developing apprenticeship systems. Mature apprenticeship models tend to share similar characteristics. These characteristics define the nature in which students interact with employers and training providers and the protections afforded all social partners involved in apprenticeship provision. Apprenticeships “operate within the wider context of cultural traditions and aspirations of individuals and the complexity of labor market regulation.”²⁷ As such, it is important to anticipate these characteristics within the wider context of the system it is embedded in; successful apprenticeship implementation needs to allow for flexibility within a guiding framework.

Legislation is coherent and aims for a simple but effective framework. This includes good governance to ensure that apprenticeship is not synonymous with cheap labor. This governance should ensure the close cooperation of partners (including employers, educational institutions, and community based organizations). Legislation can provide guideposts for setting up high quality apprenticeship systems; a legal framework should clear rights and responsibilities of the apprenticeship partners, but leave “questions of apprenticeship content, assessment, and certification to be agreed between employer and employee representatives.”²⁸ In particular, legislation should secure the rights of an apprentice as an

²⁵ ²⁵ Steedman, 2012. Ibid.

²⁶ Indeed, in the United States there has been evidence of cross-party cooperation in the introduction of the LEAP Act (Leveraging and Energizing America’s Apprenticeship Programs-Senators Tim Scott (R-SC) and Cory Booker (D-NJ), which would provide a tax credit to employers to help increase the number of registered apprenticeships in the United States.

²⁷ Steedman, 2012.

²⁸ Steedman, 2012

employee, but with particular provisions that address separate minimum wage provisions for young apprentices and recognize the unique status of the apprentice as a learner, thereby securing the right to high quality training with strong transferable elements.²⁹

Germany has provided clarification on many of these questions through the 1969 Vocational Training Act in Germany determines the length of apprentice training and the examinations to be carried out by chambers of commerce to test workplace learning, and requires that employers release apprentices to take these tests. Each employer and sector representatives is required to draw up a detailed description of workplace learning for each apprenticeship occupation (with the understanding that the framework encourages transferable skills and knowledge within an occupational context). In this case, the principle of employer responsibility for content is established (vocational training is in the hands of firms and chambers) while defining the basic framework that guarantees the mutual rights and obligations of employers and apprentices. This obligatory but flexible framework is crucial to the potential for cross-national transfer of apprenticeship models to succeed. The role of the government is critical to the success of these models, but does not introduce rigidity into the system.

Apprenticeships are designed for two core purposes: to ease the transition from school-to-work for students (which is of particular importance to those students who are otherwise socially dislocated) and to provide employers with a systemic mechanism to prepare employees for employment in their sector. Apprenticeships provide an appealing “third-way” for students who are not entering directly into a University program or who are not directly entering into full-time employment. Legislation, therefore, can provide strong

²⁹ For an excellent discussion, see Steedman 2012 and OECD Note 2012.

signals to “youth, their families, and communities...that it is not all right to enter adulthood without completing at least upper secondary vocational education.”³⁰

Legislation in other OECD countries can be in the form of youth guarantees (a guarantee of employment, apprenticeship, or other education for youth who are neither in education, nor employment or training), mutual obligation policies (often called “activation policies” that entail agreements or compacts among young people, their families, and the government that the “young person will actively seek work and stay in training in exchange for targeted actions to help them”), adapted work and learning programs (where the vocation, education, and training pathway is somehow altered or adapted to serve at-risk youth), and/or intensive career guidance and counseling (career exploration and often individualized career advising).³¹

What legislation absolutely should work to avoid is to attempt a universal approach to apprenticeship system development. A sector-based approach, where there is incentive to designate flexible best practice occupational standards for apprenticeships, will ensure that industry is an active participant in the development of apprenticeship programs.³²

Apprentices are in many ways a “pool” of labor for companies in a particular sector, due to the transferable nature of the skills that have been acquired. A sector based approach sustains the public-private partnership, assures the quality of formal apprenticeships as well as the apprentices’ eventual employment, and incentivizes industry participation in creating the best practice occupational standards.³³

³⁰ Hoffman, Nancy. 2011. *Schooling in the Workplace: How Six of the World’s Best Vocational Education Systems Prepare Young People for Jobs and Life*. (Harvard Education Press:

³¹ For a thorough discussion of these policy options, please see Hoffman, Nancy. 2011. *Schooling in the Workplace: How Six of the World’s Best Vocational Education Systems Prepare Young People for Jobs and Life*. (Harvard University Press: Cambridge University Press): pgs 150-165.

³² For a thorough review of this policy option, please see Lerman, Robert I. 2014: *Expanding Apprenticeship Opportunities in the United States*. The Hamilton Project. Policies to Address Poverty in America. Eds. Kearney, Melissa S., Benjamin H. Harris, and Karen L. Anderson.

<http://www.brookings.edu/research/interactives/2014/hamilton-policies-addressing-poverty>

³³ For more information, see International Labor Organization. 2013. *Apprenticeship Systems-What do we know?* http://www.ilo.org/beirut/media-centre/fs/WCMS_214722/lang--en/index.htm

Across sectors, legislation at the federal and state level can extend the use of subsidies and/or tax credits to apprenticeship in a much more intentional manner. Based on European examples, collective funding ensures that there is broad-based support for apprenticeships and a rebalancing of incentives from recruitment towards training. For instance, Denmark, in order to incentivize employers to take on apprentices, created the employers reimbursement scheme (Arbejdsgivernes Elevrefusion, AER), which all employers, both public and private, are required to pay into, regardless of whether or not they provide training to apprentices or not. The fund then reimburses the company for the apprentices' wage when the student is attending college.³⁴ While this scheme is unlikely gain much purchase in the United States, the spirit of creating incentives for employers and institutions to participate is what should be taken from this. This can take the form of paying for performance, where technical education and training organizations earn revenue only for additional apprenticeship programs that they develop with employers or through tax credits across sectors.³⁵

The primary relationship is that between the employer and apprentice (but don't ignore existing resources). This takes the primary responsibility of the "student" away from the education institution into which it is embedded, which encourages investment in the apprentice as a member of the firm, and allows the apprentice to develop valuable relationships beyond the academic institution that will be invaluable in the post-apprenticeship environment. This can translate into the amount of time apprentices actually spend in work placement with employers which can require a rethinking of kind of flexibility that is required in order to build a successful apprenticeship program, which can vary by

³⁴ For more information see: Trampusch, Christine/Eichenberger, Pierre/de Roo, Micha/ Bartlett Rissi, Robin/Bieri, Isabelle/Schmid, Laura/Steinlin, Simon (eds.) (2010). Initial Vocational Training in Denmark. REBECA (Research on Social Benefits in Collective Agreements). Database, Part 2 'Social Benefits in Collective Agreements'. SNF-Project No. 100012-119898. Institute of Political Science, University of Berne.

³⁵ See Lerman, Robert I. 2014.

sector. The workplace, not the school, should be considered the “center of their world” for apprentices, which is very much in the spirit of a dual-system training model.³⁶

This relationship is not necessarily an intuitive one in a context where real-world learning is not the norm for most students. Employers need to be in the “driver’s seat” in the formation of apprenticeships, and a potential policy response should focus on the maximization of engagement by large employers in this effort. By making apprentices employees, with specific provisions and protections for both employers and employees (apprentices), it alters the nature of the relationship between the apprentice and the workplace.

The role of the community college as a critical component in the training cycle is not to be negated, however. Community colleges serve as the main providers for academic instruction for the majority of apprenticeship programs in the United States, as are they the natural conduit for the majority of Career and Technical Education programs of study that extend from the secondary into post-secondary institutions. They play an important and critical role in extending affordable higher education opportunities to all students, particularly to otherwise disadvantaged and non-traditional students. As Lerman points out, policy makers often see apprenticeships and community colleges as being substitutes for one another, as two approaches to achieving a similar goal. Rather than substitutes, the two systems can often act as complements to each other, and the community college can act as an important supportive structure to the delivery of the training for apprenticeships.³⁷ Policy-makers in the United State are struck by the idea that the German Apprenticeship “dual-training” model at the secondary level is transportable in its entirety, but that potentially ignores the expansion of the dual-study model which emphasizes more training at the post-

³⁶ For more information, see: Hoffman, Nancy. 2011.

³⁷ Lerman, Robert. 2010. *Expanding Apprenticeship: A Way to Enhance Skills and Careers* (Research Report). Washington, DC: Urban Institute.

secondary level. While a great deal can be learned from the introduction of pathways of learning at the secondary level from the German models (particularly those that lead into apprenticeship programs), community colleges offer a unique solution to the issue of the development of middle-skills at the post-secondary level that is accessible to many students. Community colleges can leverage their location in the community to attract a wide range of students, particularly those students who are otherwise disadvantaged and may have difficulty attending a traditional 4 year University. Offering school-to-work transitions with a clear path from high school into a post-secondary arrangement is something that Community Colleges are well positioned to do.

The connection between the community college and apprenticeship programs offer a potential leverage point for states as they build out more programs. Community colleges, because they play a crucial role at the community level to provide post-secondary options that are accessible to all students, also have the potential for playing a greater role vis-à-vis the delivery of apprenticeship programs. Quality apprenticeships “work best if they are jointly managed by the social partners and relevant institutions” and often community colleges, due to their existing networks can act as trusted brokers.³⁸

An example that leverages the resources and reach of community colleges at the state level exceptionally well is Apprentice Carolina, which is actually a division of the South Carolina Technical College System. Apprenticeship Carolina is a public-private partnership that in 2007 was driven by efforts of the South Carolina Chamber of Commerce and through a \$1 million initial legislative investment increased the number of employers offering apprenticeships by nearly 700 percent through a combination of marketing, technical assistance, and employer tax credits. This model is compelling because of the close partnership between the public and private sectors that leverages the expertise of both. The

³⁸ OECD. 2012. *Note on “Quality Apprenticeships” for the G20 Task Force on Employment.*

South Carolina Chamber of Commerce, using state funds to support research, documented a skills gap, recommended apprenticeships as a strategy to address it, and identified the barriers that kept employers from participating. Legislative strategies were implemented to increase employer participation (including financial incentives, marketing, and technical assistance through Apprenticeship Carolina). Through this partnership, Apprenticeship Carolina is able to support all 950 occupations that are registered through the Department of Labor Office of Apprenticeship and over 700 employers sponsor programs across the state.

A strong intermediary is key to a strong apprenticeship program. A successful, far reaching apprenticeship program should have a strong intermediary that can act as a trusted broker to coordinate between stakeholders, including employers, educational institutions, the Department of Labor, and state governments. Over 2 decades ago, Tom Bailey pointed out that in order for an apprenticeship system to succeed, it needed to overcome a significant institutional problem.

“There needs to be some overarching institution trusted by employers and workers (and unions where they exist) that can coordinate individual employers’ participation and that can help the schools work with business. At least in the early stages, if employer participation is dependent on cajoling by individual schools, then the approach is doomed to remain marginal and at the mercy of the energy and commitment of individual enthusiasts.”³⁹

The intermediary can help to create synergy across stakeholders, and to conduct and provide technical assistance to employers.

In Switzerland, known for its high percentage of apprenticeship participation (over 60% of the general population of students participate in apprenticeship programs), vocational education and training (VET) governance is shared between the national and “state” level.⁴⁰

At the federal level, the body in charge of education is the State Secretariat for Education,

³⁹ Bailey, Tom. 1993. *Can Youth Apprenticeship Thrive in the United States?* Educational Researcher, April 1993 (22): 4-10.

⁴⁰ The influence of federal level is rather low, whereas the cantons (or “state” level) have much more authority in these matters.

Research, and Innovation (SERI). This reach of this level is rather limited, whereas the twenty-six cantons, as well as numerous private-interest organizations, are engaged in regulating socio-economic institutions.⁴¹ Unlike apprenticeship systems in Germany and Austria, the Swiss system is embedded in a rather liberal labor market setting, where the influence of trade unions on the VET system is rather limited (but with a noted consultation role), whereas the role of private industry is more emphasized. However, the governance of VET is the joint responsibility of the Confederation (represented at the federal level by SERI), the cantons, and professional organizations, which include trade associations, industry associations, social partners, other responsible organizations and VET providers and businesses, as well as private individuals.⁴² These three levels of organization share the governance of the VET programs, which are delivered through a variety of local intermediary organizations.

In the United States, there are emerging models that build upon the knowledge of developed apprenticeship systems in their development of apprenticeship programs through the use of an intermediary organization. In Kentucky, the focus on manufacturing as a mechanism to drive regional economic growth, formed the basis for the Bluegrass Economic Advancement Movement, which is a regional partnership between Louisville and Lexington, and stimulated the creation of the Kentucky Manufacturing Career Center and the development of KY FAME (Kentucky Federation of Advanced Manufacturing Education).⁴³ KY FAME is a consortium of regional manufacturers that work together to implement dual-track, apprenticeship-style training through partnerships with local technical colleges to deliver the Advanced Manufacturing Technician Program. The consortium of businesses is

⁴¹ Graff, Lucas. 2014. *The Swiss Apprenticeship System. Its Institutional Specificities and Strengths in International Perspective*. American Institute for Contemporary German Studies.

⁴² Swiss education. *Governance of vocational and professional education and training*. <https://swisseducation.educa.ch/en/governance-vocational-and-professional-education-and-training>

⁴³ Barker, Rachel and Amy Liu. 2015. *In Kentucky, manufacturers partner to bridge the skills gap*. Brookings. <http://www.brookings.edu/blogs/the-avenue/posts/2015/03/04-kentucky-manufacturers-skills-gap-barker-liu>

brought together through the intermediary organization, who has partnered with the German American Chamber of Commerce as part of its Skills Initiative. This partnership is an important element, in that the GACC provides the training, certification, and assessment materials, as well as coordination support, to help bring businesses to the table.

Intermediary organizations play a crucial role in the development of new and emerging apprenticeship programs and help to maintain developed apprenticeship systems.

Intermediary organizations provide continuity in the function of systems, such as standards setting, quality assurance, training, advocacy, fund development, and data collection.

Drawing from the work of collective impact, intermediary organizations act as *backbone* organizations, who a) guide vision and strategy; b) support aligned activities; c) establish shared measurement practices; d) build public will; e) advance policy; and f) mobilize funding.⁴⁴ In terms of intermediary support for apprenticeship programs, the local

development of an organization that can act as convener and facilitator in partnership with a national (or international) body with credible private industry support can create the conditions for successful program development. The Swiss model, in fact, provides an “interesting model for how other federal countries can develop apprenticeship systems that allow the federal and state levels, through numerous intermediary organizations, to work together.”⁴⁵ In the Swiss model, regional diversity in programs is seen as an asset rather than a cause for concern, as the regional diversity acts in many ways as a form of “laboratory federalism” in which VET programs can be tested locally, and if successful, diffused at the national level.⁴⁶ The diffusion of the German dual-system model in the United States through Mat², KY FAME, and in Illinois, ICATT (Illinois Consortium for Advanced Technical Training) shows promise of this type of national diffusion.

⁴⁴ Turner, Shiloh, Kathy Merchant, John Kania, and Ellen Martin. 2012. *Understanding the Value of Backbone Organizations in Collective Impact*. Stanford Social Innovation Review. www.ssireview.org

⁴⁵ Graf, 2014. Ibid.

⁴⁶ Graf, Lucas. Ibid.

There is a structured program of learning, but training occurs both on- and off-the-job, where recognized and transferable certifications are given to students who complete apprenticeships. (Where feasible, apprenticeships should be integrated into an existing program so as to provide apprentices not only with a certification, but with a degree). A structured program of learning ensures that at the end of their apprenticeship period, apprentices have “acquired relevant skills for durable and productive working careers.”⁴⁷ This should also ensure that training is not too narrowly focused-it should also cover broader skills that make an employee (student) well rounded. This allows apprentices to develop and maintain “the ability to progress in their careers and adapt to change after they have left the program.”⁴⁸ Both on and off the job training work together to form the apprenticeship experience. Theoretical learning underpins the experiential learning and training that takes place in the workplace. This is a crucial component, and a cornerstone of the movement to provide work-based learning experiences and opportunities to students.

In the development to apprenticeship models for younger students, real-world application of learning through work-based learning creates conditions for career awareness, exploration, and self-efficacy. Particularly for younger students, hands-on work in real settings creates a tangible connection between their efforts and the world of work. However, to facilitate this, apprenticeships can and should be certified and well integrated into a formal schooling system. By ensuring that the content of the training component is “certified through a system of nationally-recognized qualifications and competencies” and safeguarding student choice to move from an apprenticeship program into further education, apprenticeship programs can mitigate the challenges that students and employers often face when contemplating participation in an apprenticeship program. The crucial component is a

⁴⁷ OECD. 2012. Ibid.

⁴⁸ OECD. 2012. Ibid.

“nationally-recognized” and valued credential, a credential that will be recognized by employers; this ensures that there is flexibility in the labor pool, which benefits all employers.

In addition, the assessment of skill development can be based on competencies learned, rather than seat-time in the classroom. An excellent example of this is the **NIMS (National Institute for Metalworking Skills) Certified Registered Apprenticeship Program**. In this program, apprentices must demonstrate required competencies as they progress through their training while earning a series of NIMS credentials. In addition to these required competencies, employers are able to add competencies that are relevant to their own companies. By setting a competency-based standard for completion, this program allows for flexibility for both employers and apprentices.⁴⁹

However, research has indicated an extremely low-level of awareness of competency-based education among hiring managers (of both the approach and its value proposition for the business).⁵⁰ Employers that are “rooted in traditional hiring practices” tend to measure general skill attainment through the acquisition of associates or bachelor’s degrees, which creates additional hurdles in the development of programs that are designed around industry needs.

The Wisconsin Youth Apprenticeship program offers a useful study in the development of a program that ties competency-based education to the application of study through work-based learning, particularly for young learners. The program in Wisconsin is loosely based on the German model and has focused on the integration of school-based and work-based learning to provide the student with academic and technical skills that lead to a High School diploma and a Certificate of Occupational Proficiency. Movement through the

⁴⁹ Ayres, Sarah. 2014. *National Standards for Strong Apprenticeships*. Washington Center for American Progress. <https://www.americanprogress.org/issues/economy/report/2014/08/27/96088/national-standards-for-strong-apprenticeships/>

⁵⁰ Franklin, Chip and Robert Lytle. 2015. *Employer Perspectives on Competency-Based Education*. AEI Series on Competency-Based Higher Education.

Youth Apprenticeship program, which is geared towards the last two years of high school, for juniors and seniors, is measured on competencies acquired, and parents/guardians, instructors and employers participate in regular progress reviews of the apprentice.⁵¹ Local programs provide training based on statewide youth curriculum guidelines, which are endorsed by business and industry.

As noted earlier, the German American Chamber of Commerce, through its Skills Initiative, has developed programs in Kentucky, Michigan, and most recently in Illinois around the dual-system apprenticeship model. MAT², a three-year program that rotates apprentices in blocks periods (6-7 weeks) of classroom instruction at participating community colleges and on-the-job training at participating firms, is focused on the development of Mechatronics technicians, IT technicians, and technical product designers. The development of the curriculum, standards, and competencies, much as in the Wisconsin model noted above, are regulated. All curriculum, training materials, and assessments have all been translated from German into English, and have been developed as part of occupational profiles in Germany. As such, upon graduation of this program, apprentices will receive an associate's degree from the community college, a DOL Registered Apprenticeship Certificate of Completion, and a German DIHK-issued certificate, which is recognized by employers as the highest standard for Mechatronics certification around the world.

What can be learned from both of these examples is that companies need agreement on industry standards and the competencies apprentices should acquire in order to have met those standards. Often a state-supported body, a national accreditation source, or an international organization can facilitate the mechanism by which industry can agree, and can also provide a more nimble structure for occupation profiles that can easily change over time.

⁵¹ Mauldin, Bronwyn. 2014. *Exploring how Career Technical Education, Work-based Learning, and Apprenticeship can Address Youth Unemployment and Meet Employer Needs for Skilled Workers*. Prepared for the Annie E. Casey Foundation. http://www.workforce-matters.org/uploads/4/0/3/1/40318717/youthappren_aecf_final_05142014.pdf

There is an equitable sharing of costs among employers, the public, and

apprentices: Apprentice programs are not inexpensive initiatives, however, these costs “should be shared in accordance with the private benefits that accrue to employers and apprentices as well as the social benefits more generally.”⁵² Particularly in the United States, in the absence of any public intervention to support the development and/or replication of apprenticeship models, there is a potential that employers may provide less rigorous training or may be disinclined to participate. As is noted in a brief sponsored by the Center for American Progress: “a little public investment goes a long way.”⁵³ Incentives can take the form of government subsidies for the training component of the program, but can also take the form of tax credits, direct subsidies to the apprentice or firm, or at completion of the apprenticeship (if the apprentice is hired). In the Apprenticeship Carolina model, South Carolina provides a modest \$1000 employer tax credit. This tax credit does not cover the costs of sponsoring an apprentice, but it does serve as a “vital marketing tool that brings employers to the table.”⁵⁴ In an example of a local effort at driving incentives towards apprenticeships, the Cook County Board in Chicago, Illinois voted in late May, 2015 to give companies that hire certified apprentices an earned credit of one percent of their bid amount for hiring apprentices who will complete more than 10 percent of the work on county projects.⁵⁵ These small public sector commitments send important signals to employers that often incentivizes their participation. In Switzerland, incentive schemes give preferential treatment during contract negotiations to firms who train apprentices, which means that “all things being equal, the fact that a company is training apprentices will increase its chance of

⁵² OECD. 2012. Ibid.

⁵³ Steinberg, Sarah Ayres and Ethan Gurwitz. 2014. *Innovations in Apprenticeship*. Center for American Progress.

⁵⁴ Ibid.

⁵⁵ Firms in which apprentices are to perform five to 10 percent of the work may now receive a 0.5 percent bid incentive. <https://cook-county.legistar.com/MeetingDetail.aspx?ID=398974&GUID=55643CDD-0268-4F12-8E62-A4AC8BF5433C&Search=>

winning a bid.”⁵⁶ The empirical evidence suggests that there is a “significant association between a firm’s willingness to train and the existence of such preferential treatment in public procurement.”⁵⁷

What is clear is that “both apprentices and employers need to see a return to their investment in training.”⁵⁸ The decision by a firm to invest in apprenticeship training in large part stems from a recognized need that the training that needs to be provided to an employee can be done best through a model that combines schooling and work. It has been pointed out that “although it is difficult to measure relative costs and benefits of apprenticeship, the key issues are: a) cost-sharing between the taxpayer and business; b) cost-sharing between the apprentice employer and the apprentice; c) cost-sharing between the apprentice employer and the employer who recruits ex-apprentices.”⁵⁹ For the apprentice, a lower apprentice pay than they may make elsewhere may be an acceptable condition, provided that “the apprenticeship training results in a sufficiently high rate of return to education.”⁶⁰ In a cost-benefit analysis of apprenticeship training, the following categories are relevant:

| Firms Cost of Apprenticeship Training | |
|--|--|
| <i>Wages of Apprentices</i> | Regular wage payments, irregular wage payments, compensation for expenses. |
| <i>Costs for Training Personnel</i> | Costs for full-time, part-time, and external training personnel for the period in which they are unable to work productively because of apprenticeship instruction. |
| <i>Recruitment and Administrative Costs</i> | Wage costs for administrative tasks and recruitment related to apprenticeship training |
| <i>Costs for Infrastructure</i> | Machinery/appliances for apprentices at the workplace, rent for premises necessary for apprenticeship training, cost of premises and infrastructure for company training centers |

⁵⁶ Muehleemann, Samuel and Stefan C. Wolter. 2013. *Return on investment of apprenticeship systems for enterprises: Evidence from cost-benefit analyses*. EENEE Analytical Report No. 16. Prepared for the European Commission.

⁵⁷ Ibid.

⁵⁸ Steedman, Hilary. 2008. *Time to look again at apprentice pay? Getting cost-sharing right*. SSSA Catalyst, Issue 5.

⁵⁹ Ibid.

⁶⁰ Muehleemann and Wolter. Ibid.

| | |
|---|---|
| <i>Costs for Supplies</i> | Cost of supplies used for non-productive activities in the workplace, including books, software, and working equipment. |
| <i>Other Costs</i> | Cost of fees (such as exams), capital costs for recruitment/administration related to apprenticeship training, costs of external courses, duties and taxes to third parties. |
| Firm Benefits of Apprenticeship Training | |
| <i>Value of Skilled Tasks</i> | The value of having apprentices perform a skilled task is calculated as the time that apprentices spend on such tasks, multiplied by the wage that a firm would need to pay skilled workers if no apprentices had been hired. That value, however, is further multiplied by the productivity of an apprentice relative to that of a skilled worker. |
| <i>Value of Unskilled Tasks</i> | The value to a firm of having an apprentice perform unskilled work is the wage that the firm would have had to pay to employ an unskilled worker. |
| <i>Technology Transfer</i> | Provided that vocational schools are well-equipped, young people can bring to the company the newest knowledge from the training institute. ⁶¹ |
| <i>Pipeline Development</i> | Employing apprentices is potentially a unique source of recruitment for companies; if designed correctly, an apprenticeship system creates a “pool” of potential employees for an industry sector. |

Adapted from Muelemann and Wolter. 2013. *Return on investment of apprenticeship systems for enterprises: Evidence from Cost-Benefit Analyses*.

A brief study of these characteristics underscore the importance of intermediary organizations and consortium models for cost-sharing between firms, third-party organizations, and the state. These firm costs and benefits in relation to the broader unemployment dynamics are particularly relevant for small-to-medium businesses, which account for over 95% of firms and 60-70% of employment in OECD countries.^{62 63} Small-to-medium businesses are a particularly vulnerable element in the economy; these businesses tend to be much more susceptible to changes in the market or to changes in skill needs. Their small size and lack of

⁶¹ Steedman, Hilary. 2012. *Overview of Apprenticeship Systems and Issues*. ILO contribution to the G20 Task Force on Employment.

⁶² Most OECD countries consider Small to Medium Enterprises to be firms with less than 250 employees. Some countries set the limit at 200 employees and the United States considers SMEs to include firms with fewer than 500 employees (OECD, 2000).

⁶³ Jansen, Marion and Rainer Lanz. 2014. *Skills and Export Competitiveness for Small and Medium-Sized Enterprises*. World Trade Organization: Global Review of Aid for Trade. https://www.wto.org/english/tratop_e/devel_e/a4t_e/global_review13prog_e/skills_and_export_competitiveness_e.pdf

internal training market create very real barriers to creating a training program that creates a talent pipeline that they can draw from. Small businesses generally have limited infrastructure to reach out to potential job applicants, which creates fundamental disadvantages not only for the business, but for the potential employee for whom that opportunity is likely to be missed. Very few small-to-medium sized firms are able to access the benefits provided to them by apprenticeship participation given their limited resources, which make a cost-sharing and consortia model a much more feasible arrangement.

Quality apprenticeship systems should attempt to cover multiple sectors and occupations in innovative, high growth areas and should encourage the participation of women. In order to ensure that apprenticeships are inclusive and that apprentices acquire the skills that are required in new and innovative sectors, non-traditional sectors and occupations need to be targeted for apprenticeship development. This should be framed in the context of STEM (Science, Technology, Engineering, and Math) education, training, and employment. From a workforce development perspective, STEM job creation over the next ten years will outpace non-STEM jobs significantly. A 2014 study by the Brookings institute indicates that “STEM skills are widely needed across a wide variety of blue-collar, craft, and professional occupations” and that “the rewards for both education and STEM skills have grown relative to other positions, and workers in STEM today are among the highest paid.”⁶⁴ The U.S. Department of Labor has indicated that the nation’s “economic future depends upon improving the pipeline into STEM fields for sub-baccalaureate students as well as BA and advanced degree holders, for youth moving toward employment and adults already in the workforce, for those already employed in STEM fields and those who would like to change

⁶⁴ Rothwell, Jonathan. 2014. *Still Searching: Job Vacancies and STEM Skills*. <http://www.brookings.edu/research/interactives/2014/job-vacancies-and-stem-skills#/M10420>

careers to secure better employment and earnings.”⁶⁵ Projections of jobs and education requirements indicate that the occupational clusters that are most representative of those best suited to apprenticeship are in STEM fields.

However, participation of women in high-paying STEM fields is low in comparison to men. Based on a report by the U.S. Chamber of Commerce Foundation, the number of STEM jobs increased by 21% more than non-STEM jobs and approximately 57% of those STEM jobs were “core”⁶⁶ STEM and 43% were STEM-related (which include architecture and healthcare, sectors in which women are highly represented). Particularly in the healthcare sector, the participation of women has more than doubled over the past 20 years. But, while accounting for 43% of total STEM jobs, women accounted for only one-quarter of core STEM jobs.⁶⁷ The lack of women in core STEM occupations is particularly troubling from a firm, individual, and macro-economic perspective: STEM knowledge capital is key to the basic scientific research that leads to growth which is crucial for both businesses and employees; STEM workers can expect higher salaries, and a focus on increasing STEM education resources and investments lead to greater employment opportunities that help address important inequality issues; and the greater participation of women in occupations of high-growth occupations is key to a “out-innovate, out-educate, and out-build” strategy to improve macroeconomic conditions in the United States.⁶⁸

A key determinant of women’s participation in the STEM labor force is the STEM education she receives: “lower STEM education rates for women contribute to the

⁶⁵ Department of Labor. 2007. *The STEM Workforce Challenge: the Role of the Public Workforce System in a National Solution for a Competitive Science, Technology, Engineering, and Math (STEM) Workforce*. http://www.doleta.gov/youth_services/pdf/STEM_Report_4%2007.pdf

⁶⁶Core STEM domains include occupations in life and physical sciences, technology, engineering, mathematics, and social sciences; the STEM related domain includes architecture and health care.

⁶⁷ U.S. Chamber of Commerce Foundation. *Reaching the Full Potential of STEM for Women and the U.S. Economy*. <https://www.uschamberfoundation.org/reports/reaching-full-potential-stem-women-and-us-economy>

⁶⁸ White House Office of Science and Technology Policy. 2015. *Women in STEM*. <https://www.whitehouse.gov/administration/eop/ostp/women>

underrepresentation of women in core STEM occupations.”⁶⁹ Jobs in STEM fields require greater knowledge and formal training, two requirements well suited to the format of apprenticeship training. In most OECD countries, however, fewer young women than young men undertake apprenticeships, particularly in non-traditional STEM fields.⁷⁰

In this respect, the gender dynamics in Career and Technical Education (CTE) in the United States can be very illustrative. CTE in the United States is a primary vehicle for students to learn practical, technical skills oriented to specific occupations and is oriented around 16 national “career clusters” ranging from agriculture, food, and natural resources to human services.⁷¹ In the United States, CTE serves 94% of secondary students, and at the federal level, is primarily funded through the Carl D. Perkins Career and Technical Education Improvement Act (Perkins). A chief goal of the Perkins act is to “provide education for career or jobs in high-paying, high-skill fields by increasing participation and enrollment of students in nontraditional CTE fields to achieve more equitable outcomes by gender.”⁷² Historically, CTE (or vocational courses) were deeply segregated by gender; gender equity in CTE can directly be traced to Title IX of the Educational Amendments of 1972, where language instructed that it was unlawful for schools to “steer students into career and technical education classes based on their gender.”⁷³

Research on CTE programs of study, however, indicate that barriers to equality in CTE remain high and that there is a disproportionate enrollment of men and women in programs that tend to lead to those occupations that have historically been dominated by gender. The gender disparity in these programs has serious implications for STEM fields

⁶⁹ U.S. Chamber of Commerce Foundation. Ibid.

⁷⁰ OECD. 2014. Promoting better labour market outcomes for youth. Report on youth and apprenticeships prepared for the G20 Labour and Employment Ministerial Meeting.
<http://www.oecd.org/g20/topics/employment-and-social-policy/OECD-ILO-Youth-Apprenticeships-G20.pdf>

⁷¹ For further information, please see <https://www.acteonline.org/cte/#.VYM2HflVikp>

⁷² Gioiosa, Carmen. 2014. *Gender Equity in CTE and STEM Education*. Insights on Equity and Outcomes: Office of Community College Research and Leadership. Issue 6: May 2014.

⁷³ National Coalition for Women and Girls in Education.

more broadly, as there is a direct connection between what is defined as Science, Technology, Engineering, and Math occupations; CTE programs tend to dovetail with STEM programs due to the nature of the national career clusters and the occupations they cover, and are often pathways into STEM occupations. Both STEM and CTE have been and continue to be underrepresented by women. The National Coalition for Women and Girls in Education found that “females made up less than 25% of participants in science, technology, engineering, and math programs nationally (21% at the secondary level and 24% at the postsecondary level), and much lower numbers in manufacturing (17% and 11%, respectively).”⁷⁴ For the purposes of developing a skilled workforce, these numbers are particularly troubling. The lack of access to work and training opportunities in high growth fields is a “societal problem that results in underdeveloped human resources.”⁷⁵

The linkages between Career and Technical Education, apprenticeship models, and the institutions in which they are embedded offer a new potential for fixing an old problem, namely, the expansion of underrepresented populations into nontraditional fields. Early exposure to STEM fields through career and technical programs, often through mandatory and robust programs that aim at breaking down traditional barriers for underrepresented populations, is a key determinant to how women will engage in STEM careers later on. Students in pathways and pre-apprenticeship programs receive early exposure, which can translate into greater comfort, familiarity, and understanding of STEM careers. Getting students into these programs often requires active recruitment and meaningful support services, along active intra-program steps to break down gender and minority biases and

⁷⁴ National Coalition for Women and Girls in Education (NSWGE). 2012. *Title IX at 40: Working to ensure gender equity in education*. Washington, D.C.

⁷⁵ Daines J., Hartenstein, A., & Birch, M. 2000. *Women, education, and training: Old challenges in a new age*. In D. R. Herschbach & C. P. Campbell (Eds.), *Workforce preparation: An international perspective* (pp. 22-33). Ann Arbor, MI: Prakken Publications, Inc

discrimination.⁷⁶ But linking existing career and technical education into pathways that include work-based learning creates the experiential environment that is key to STEM exposure.

Apprenticeships, particularly those that are directly tied to feeder programs which encourage the participation of girls and other underrepresented populations, offer one mechanism for increasing the number of minorities in nontraditional occupations. Policy interventions, such as the Women in Apprenticeship and Nontraditional Occupations Act (WANTO)⁷⁷, that encourage and incentivize programs that make implicit connections between secondary and postsecondary schools through internships, career awareness/exploration programs, and dual-credit opportunities offer ways that local communities can target resources for underrepresented populations.

Conclusion

Apprenticeship offers a unique mechanism for connecting learners to the work of work, and cross-national lessons can and should inform the design of systems in the United States. Given the attention on career pathways system development and a broader recognition that education and employment opportunities need to be better aligned for improved workforce outcomes to support both skill and physical gaps in many industry sectors, the time is right for federal and state supports to drive innovation in developing apprenticeships, particularly for those programs that emphasize the importance of the employer/employee relationship and that make meaningful efforts to drive the participation of underrepresented

⁷⁶ AAUW Issues. Career and Technical Education. <http://www.aauw.org/what-we-do/public-policy/aauw-issues/career-and-technical-education/>

⁷⁷ WANTO is the only federal program designed specifically to help women enter nontraditional occupations, defined by law as those in which women make up 25% of the workforce. WANTO was signed into law in 1992 for the purpose of providing technical assistance to employers and labor unions to encourage the employment of women in apprentice programs and nontraditional occupations. This program is very modestly funded at \$1 million per year; a policy response to deal with the underrepresentation of women in nontraditional occupations would be to provide more funds that encourage “reach” down programs into high schools and middle schools to target girls earlier.

groups. Apprenticeships systems should encourage innovation, such as in the intelligent use of technology to deliver instruction and in the development of consortia models for coordinating industry partners around occupational and industry needs.

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