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Registered apprenticeship training in the US construction industry

Registered
apprenticeship
training

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Abstract

Purpose – This paper aims to compare the performance of building trades apprenticeship programs in the USA, sponsored jointly by employers and unions, with those sponsored unilaterally by employers. It reviews enrolment and graduation rates, including participation of women and minorities. The article also looks behind the numbers to examine the operation of apprenticeship. It reviews the evolution of joint programs, including institutional arrangements and recent innovations to cope with the challenging characteristics of construction labor markets.

Design/methodology/approach – Statistical comparisons by type of program sponsor are carried out using individual-level data on registered apprenticeship for the period 1996-2003. Evolution of apprenticeship programs is discussed in a historical perspective.

Findings – Joint programs (with union participation) were found to have much higher enrolments and greater participation of women and ethnic/racial minorities. Joint programs also exhibit markedly better performance for all groups on rates of attrition and completion. Joint programs have developed various innovations, including college credit for training and scholarship loans to expand apprenticeship and improve quality and retention, although there are no quantitative evaluations of the effectiveness of many of these specific measures.

Research limitations/implications – Statistical information includes about 65 percent of all registered apprentices in the USA.

Practical implications – The paper shows that alternative forms of training sponsorship have substantially different effects on enrolment and graduation. Identification of the practices, that improve enrolment and retention, and their widespread adoption would enhance the effectiveness of training programs.

Originality/value – The dataset used in this paper has not yet been used in any publications. The findings regarding joint programs are notable, in view of the skilled labor shortages facing the construction industry in the USA.

Keywords Apprenticeships, United States of America, Construction industry, Trade unions

Paper type General review

Introduction

Although more than 850 occupations are deemed “apprenticeable” in the USA, the majority of registered apprentices continue to be concentrated in a few building trades

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– for two very good reasons. First, the combination of practical and theoretical learning gained through on-the-job training and classroom learning in apprenticeship has been found especially suitable to produce the broad “all round” skills needed in construction crafts rather than narrowly trained specialists. Second, building trades programs in the unionized sector have developed an institutional infrastructure designed to cope with the challenges posed by construction labor markets. These institutions include union-operated hiring halls where jobs from employers are allotted to workers, multi-employer sponsorship of apprentices, and multi-employer trust funds for training and for health and pension benefits. Institutional advances to improve the joint apprenticeship training system have continued to evolve. Recent accomplishments include the rise of national training funds and improved instructor training, increased availability of upgrade training and continuation training for journey-level workers, and arrangements for college credit for learning in apprenticeship.

Apprenticeship is not the only route to work in the skilled crafts, but it is a major source of training, providing up to an estimated 50 percent of construction craft workers in several building trades unions who are the foundation for its core craft workforce and direct-line supervisors.

The current major debate over apprenticeship training in the USA is about how the construction industry will train workers in sufficient numbers to meet its future skilled workforce needs. The first component of this debate concerns the appropriateness of apprenticeship as a training method. While the unionized sector relies largely on apprenticeship to produce fully skilled craft workers, the open shop sector favors more flexible, less formal, and shorter-term methods. Even the proponents of the latter view, however, acknowledge the strong skills that apprenticeship produces, particularly in technical trades such as electrical work, plumbing and pipefitting, or sheet metal and air conditioning work. Indeed, open shop contractors have organized their own unilateral apprenticeship programs primarily in technical trades. The second component of the debate is related to the relative performance of apprenticeship programs operating in the unionized and open shop sectors. The main issues here are whether the union participation in apprenticeship improves training in terms of enrolments, completion and quit rates, and gender and racial/ethnic diversity. In this article, we focus on these latter questions. We will first summarize the institutional differences between alternative sponsorship types. We will then use data from the US Department of Labor to compare and contrast the union-management and unilateral programs statistically and show that union participation is associated with better performance. Finally, we will review the evolution of the union-management programs and some recent innovations to illustrate how these programs are coping with the challenges they face.

Apprenticeship programs in the USA

The American apprenticeship system is a small, low profile training scheme by the standards of Germany or Switzerland where apprenticeship trains a majority of youth. According to the figures from the US Department of Labor (DOL), there were 490,000 active registered apprentices at the end of 2003 (Bennici, 2004, p. vi). American apprenticeship remains primarily a privately sponsored and privately financed system of employment-based postsecondary training that serves young adults. The

government, either via the DOL at the federal level or state apprenticeship agencies at the state level, promotes apprenticeship and provides technical assistance to establish and develop apprenticeship programs, sets and enforces standards for registration of apprenticeship, and registers and monitors apprenticeship programs. Only training programs that meet federal regulatory requirements and applicable state requirements can be registered (US Department of Labor, 1977, 1978). There is little government funding involved in American apprenticeship[1].

Registration of apprenticeship programs is voluntary and incentives to register are minimal. Registration confers some status on the programs, the sponsor and the apprentices. In addition, construction employers who work on public sector projects have some incentive to use registered apprentices because all other workers must be paid full-scale journeyworker wages under prevailing wage laws.

Registered apprenticeship programs have term lengths ranging from one to five years, although three or four years is the most common requirement. Apprentices are expected to complete 2,000 hours of supervised on-the-job training and at least 144 hours of related in-class instruction per year. Apprenticeship wages generally start at 50 percent of the journey-level wage and rise gradually, reaching 90 percent in the final training period. Apprentices usually participate in related instruction on an unpaid basis. The most common pattern is to conduct classes after the workday a couple of evenings per week from fall through spring in the sponsor's training facilities or in community or technical colleges. Classes are commonly taught by advanced journey-level workers or supervisors who work in construction during the day.

A distinguishing feature of the US apprenticeship programs is that they are sponsored either jointly by unions and employers that are signatories to collective bargaining agreements or unilaterally by employers (henceforth joint and non-joint programs, respectively). In joint programs, apprenticeship is organized under the auspices of the collective bargaining agreement that specifies the training wages, and apprentice-worker ratios. The Joint Apprenticeship and Training Committee (JATC), composed of representatives of unions and employers in equal numbers, administers the training program, making decisions concerning requirements, curriculum, and admissions, and monitoring the advancement of apprentices. Training is financed from a dedicated training trust fund into which employers contribute a few cents per every hour of labor hired. The training trust fund concept originated in the mid-1950s in local collective bargaining contracts in the mechanical and electrical trades. Once proven successful in a few localities, the trust fund concept spread rapidly and became commonly used across all the building trades. The multiple employer sponsorship system permits workers to move from one signatory contractor to another without leaving the program. Health and pension benefits are likewise established on a multi-employer basis to accommodate mobility.

The economic significance of joint programs is that they alleviate the problem of market failure in training. Individual employers tend to under-invest in training because they fear losing their investment as their workers move to other employers. This is especially a problem in the construction industry, where the attachment between workers and the firm is often casual, jobs and job sites are ever changing, and employment is subject to cyclical and seasonal fluctuations. Multi-employer sponsorship and training trust funds, negotiated through collective bargaining, mitigate this problem by offering the means to share the benefits and costs of training

among all stakeholders – workers, contactors and unions. Employers jointly pay for the training of a pool of workers and maintain a workforce with relatively homogenous skills from which they can all draw.

Non-joint programs can be multiple- or single employer programs. The former are usually organized under the leadership of a trade association, and financed by the participating employers. In contrast to the joint programs, however, participation is voluntary in these programs and no institutional structure comparable to the collective bargaining agreement exists, to assign the rights and responsibilities and to enforce the apprenticeship “contract”. Also, finding training jobs is the responsibility of the apprentices in non-joint programs, whereas the union hiring hall usually handles job placement for apprentices in joint programs, helping to assure that they rotate to gain experience in all aspects of the craft.

The performance of apprenticeship programs

In this section we present information on the characteristics of newly indentured apprentices and program sponsor types over the 1996-2003 period and their performances on the basis of the Registered Apprentices Information System database of the DOL. The primary shortcoming of this dataset is that it is not representative because 20 states do not fully report to the DOL. In our data analysis we include only the states that report fully[2]. In addition, California apprenticeship training data are obtained separately from the California State Apprenticeship Council and appended to the DOL data. Despite these limitations, this study covers about 65 percent of all new apprentices. It should be noted that many of the missing states are those in which the unions are relatively stronger. Hence, any biases the current sample is likely to be in favor of the non-joint programs.

During the 1996-2003 period, 75 percent of all newly indentured apprentices joined the construction industry programs. In contrast, manufacturing and public administration sector apprentices accounted for only 8 percent and 11 percent of the total, respectively. The average age of an incoming apprentice in construction was 27 years, much higher than that observed in other industrialized countries. This indicates the lack of integration of apprenticeship training with secondary school education in the USA. Age distribution was skewed to the right, however, with 43 percent of the apprentices aged 24 or below. Most apprenticeship programs require applicants have a high-school diploma or equivalent. Indeed almost 90 percent of the apprentices had the education level of a high-school graduate or above.

Table I lists occupational distribution of new apprentices. The top ten occupations account for 75 percent of the construction trades apprentices. The electrical and carpentry trades are by far the largest among these. The third column of the table shows the percentages of apprentices enrolled in the joint programs. Joint programs account for more than 70 percent of all registered apprentices, which is a stark figure because unionized workers constitute about 25 percent of the construction workforce. Thus the burden of training appears to be disproportionately on the unionized sector. Second, while the joint programs are organized across occupations, non-joint programs are concentrated in the electrical and mechanical (plumbing, pipefitting, and sheet metal) trades. These findings are in line with observations on occupational distribution of new apprentices in the 1989-1995 period (Bilginsoy, 1997).

	Number of apprentices	Joint program (%)
Bricklayer	13,307	80.4
Carpenter	81,681	85.3
Electrician	110,442	46.1
Operating engineer	12,864	92.1
Painter	16,101	86.9
Pipe fitter	20,071	77.4
Plumber	36,712	52.3
Roofer	27,200	87.1
Sheet metal work	22,115	77.9
Structural steel work	25,511	98.3
Other	117,381	82.4
All occupations	483,385	73.4

Source: Calculated from US Department of Labor, Registered Apprenticeship Information System and California State Apprenticeship Council database

Table I.
Occupational distribution
of new apprentices in
construction (1996-2003)

Integration of racial/ethnic minorities and women into skilled workforce and apprenticeship, especially in higher-wage trades, became a public policy issue in the 1960s and 1970s. In view of low numbers of these groups and extensive involvement of unions in training, unions have often been accused of discriminating against non-traditional workers. Table II compares the shares of minorities and women apprentices between the two types of programs across occupations. About 32 percent of apprentices belong to a minority group. It is also notable that the shares of minorities in the "higher-prestige" and higher-wage electrical and mechanical trades lag behind their overall share. This is partly due to the lower representation of Hispanics in these trades. The shares of blacks, the other large minority group, across trades are more uniform.

	All programs		Joint programs		Non-joint programs	
	Minority (%)	Women (%)	Minority (%)	Women (%)	Minority (%)	Women (%)
Bricklayer	31.6	1.6	26.0	1.7	54.8	1.1
Carpenter	34.0	4.8	34.1	5.0	33.5	3.5
Electrician	24.0	3.3	22.1	4.4	25.7	2.4
Operating engineer	28.1	14.0	27.9	13.5	29.6	20.0
Painter	42.1	6.4	42.1	6.7	41.8	4.9
Pipe fitter	20.6	2.8	19.5	3.2	24.5	1.4
Plumber	21.1	1.9	22.8	2.2	19.3	1.5
Roofer	58.6	1.6	56.8	1.7	71.1	0.9
Sheet metal work	24.4	2.2	23.1	2.3	28.7	1.9
Structural steel work	32.7	2.5	32.8	2.5	29.0	3.0
Other	37.9	3.1	39.1	3.3	32.7	2.6
All occupations	32.0	3.5	33.2	3.9	28.9	2.5

Note: Minorities include racial minorities and Hispanics

Source: Calculated from US Department of Labor, Registered Apprenticeship Information System and California State Apprenticeship Council database

Table II.
Women and minority
representation in
construction
apprenticeships
(1996-2003)

Joint programs have been slightly more successful in attracting women apprentices than the non-joint programs (3.9 percent vs 2.5 percent). Women's representation is highest in the operating engineer and painting trades. However, with an overall share of 3.5 percent integration of women into the apprenticeship labor force in construction can hardly be called a success.

Table III reports the attrition and retention rates. For this purpose we selected apprentices who started training in 1996 or 1997 in programs that require completion of the modal term length of 8,000-hours of on-the-job training. The dataset reports the status of each apprentice as of December 31, 2003 as cancelled, completed, or still in training. The first panel of Table III reports the percentages of completed and cancelled apprenticeships by program type. Overall, almost 60 percent of all apprenticeships were cancelled. This is a very large figure and should be of concern in the midst of current debates on the maintenance of the skilled labor force. There is also a wide gap between the joint and non-joint programs. In the latter, the cancellation rate is 66 percent, 12 percentage points higher than in the joint programs. Thus, joint programs not only admit more apprentices, but they also graduate more. Combining the admission and completion figures together, we find that 79 percent of apprentices who completed training graduated from the joint programs, which again underscores that joint programs carry a disproportionately heavier load of apprenticeship training.

The lower panels of Table III report completion and cancellation rates of minorities and women. Jointly sponsored programs have higher graduation rates and lower cancellation rates for all groups in comparison with their counterparts in non-union programs. In fact, the completion rates of women and minorities in union-sector apprenticeships are higher than the overall completion rate in the non-joint programs. More detailed studies controlling for other factors also confirm that the probabilities of completion of women and minorities in joint programs are higher than that of white men in unilateral programs (Berik and Bilginsoy, 2000; Bilginsoy, 2003). These statistics may surprise critics who view discriminatory behavior by unions to be the major impediment to integrating work in the building trades. While there is certainly much room for improvement – especially in bringing women into craft jobs

	All programs (%)	Joint programs (%)	Non-joint programs (%)
<i>All apprentices</i>			
Cancelled	59.4	53.9	66.0
Completed	36.8	42.8	29.5
<i>Minority apprentices</i>			
Cancelled	68.2	66.7	70.1
Completed	28.0	29.3	26.2
<i>Women apprentices</i>			
Cancelled	70.1	68.4	73.8
Completed	25.3	27.3	20.6

Table III.
Cancellation and
completion rates of
construction apprentices

Note: This Table reports the status at December 31, 2003 of apprentices who started training in an 8,000-hour program in 1996 or 1997

Source: Calculated from US Department of Labor, Registered Apprenticeship Information System and California State Apprenticeship Council database

traditionally held by men – these numbers do demonstrate that joint programs are more successful in integration of the construction workforce.

Evolution of joint apprenticeship programs

The strong performance of joint programs calls for a closer look at their operations. Despite a public perception – encouraged by critics – that apprenticeship is antiquated and inflexible, joint apprenticeship programs have demonstrated notable dynamism and vitality, as reflected in several recent progressive changes they have made. Joint apprenticeship programs have continued to evolve and innovate to meet the challenges they face. Recent advances in union-sector institutions include the establishment and growth of national training funds and national instructor training, expanded technical update training for journeyworkers, college credit arrangements for learning in apprenticeship, and adoption of scholarship-loan arrangements. These efforts attempt to raise the quality of programs, improve uniformity of skills, and attract new cohorts of high school graduates to careers in building trades by integrating apprenticeship with studies towards a college degree.

Rise of national training funds and national instructor training

The plumbing and pipefitting industry was the first to take the local trust fund concept a step further and establish an International Training Fund (covering the USA and Canada). The International Training Trust was financed by a supplemental levy on the hours worked under collective bargaining contracts in special “project agreements” negotiated by the union at the national level. Monies from the International Training Fund were used primarily to develop and improve national curricula and to train instructors of related training and apprenticeship coordinators through a contract with Purdue University beginning in 1954 (Eddy and Corcoran, 1969). Instructor training in the pipe trades subsequently was conducted at Washtenau Community College in Ann Arbor, Michigan. An organized program of courses is scheduled over five summers and includes training in pedagogy as well as technical update training, computer training, and acquainting instructors in the most recent technology used in the piping trades. The program attracts support from suppliers of new technology who have a national audience on location by exhibiting on site. The training leads to certification as an authorized pipe trades instructor. Since 1999, instructor training has been supplemented through a new network of regional training facilities owned and operated directly by the union. The process of certifying instructors is now being accelerated through distance training and teleconferencing, as well as on-line learning, through the four regional training centers, which can access the industry’s more than 300 local JATC facilities with interactive video conferencing.

Several other building trades have followed the lead of the pipe trades and established national training trust funds and/or begun national training for instructors and apprentice administrators. These include the carpenters, the sheet metal and air conditioning industry, structural steel work, the laborers, masonry trades, and the electrical industry.

The overarching mission of national training funds is to improve the quality and uniformity of training. They aim to achieve this through developing common curricular materials, initiating instructor training, monitoring the quality of local apprenticeship programs, and providing special training assistance or equipment

where it is needed. For example, when specific projects or jobs require more specialized training or certifications in the pipe trades, the union has fully equipped mobile trailers that can be taken to a local union or jobsite to provide short-term intensive training. These trailers have been used to provide specialized training for members on large projects in remote locations. As another example, the sheet metal industry national training fund offers grants and loans to its local programs to help bring the weaker programs up to the standards of the best. The rationale for all of these efforts is to help assure that a craft worker trained in one locality is prepared to work elsewhere in the country. These efforts to standardize and upgrade quality enhance the portability of training.

Expanded upgrade training for journey-workers

In addition to administering apprenticeship, JATCs sponsor an increasing variety of continuation or update training for journey-workers. For example, in the electrical industry, the JATCs offer a course on the new National Electrical Code as it becomes revised every three years. Continuation training has become a significant endeavor; but because no official public count of this activity is available, it remains largely unrecognized.

College credit for learning in apprenticeship

Providing college credit for learning in apprenticeship is not a new idea. It traces its roots to efforts by the American Council of Education to certify military training for college credit after the Second World War. Also, early efforts included pilot programs during the 1970s sponsored by the operating engineers (Abbott, 1977) and various locally developed initiatives.

During the past decade, the practice of accessing college credit has gained considerable momentum so that most of the building trades have national initiatives of one form or another underway. Several trades, including the sheet metal workers, structural steel workers, and the laborers, have negotiated college credit arrangements for their apprentices through the George Meany Center in Washington, DC, operated by the AFL-CIO. The Meany Center established the National Labor College, an accredited, degree-granting postsecondary institution which offers a Bachelor's degree in Labor Education and Labor Studies.

The National JATC for the electrical industry collaborated with Middle Tennessee State University to develop a Bachelor's degree in Construction Management with a specialty in electrical construction. First offered in fall 2003, the program is designed for students who already have completed 50 transferable semester hours of college credit from an accredited institution. An evaluation of the applicant's work experience and apprenticeship by the college may yield up to 20 additional units of upper division credit. A total of 33 semester hours of courses must be completed at Middle Tennessee State University, many of which can be completed online. Finally the program requires the student to spend one week each summer on campus, participating in presentations, hands-on projects and examinations.

In the approach used in the pipe trades, programs leading to an Associate's or a Bachelor's degree are available on an optional basis to members of the pipe trades union, the United Association. College credits are earned through the completion of apprenticeship programs, supplemented with the online/internet classes taken by

apprentices, combined with college courses taken in enrolment in local institutions. The various educational elements are combined and then evaluated by Eastern Michigan University to assure that each individual meets all the criteria for the awarding of specific degrees. These degrees options include a two-year Associate's degree in Construction Supervision, or a four-year Bachelor of Science degree in Construction Management.

The focus on college credit for apprentices has raised interest among apprenticeship instructors in obtaining college credentials. Often instructor training is combined with college credit. In the pipe trades, completion of an apprenticeship as well as the 200 hours of instruction in the Instructor Training summer program over five summers earns an instructor 45 units of college credit at Washtenaw Community College which is three-quarters of the way to an Associate degree in Industrial Training. Individuals who wish to go further can enter the Bachelor's programs at Eastern Michigan University. In the sheet metal industry, collaboration between the International Training Institute and the National Labour College allows an apprentice instructor to obtain a Bachelor's degree in Labor Education and Labor Studies with a small amount of continuing education beyond the industry's instructor training program.

Four new aspects characterize this vitalized interest in college credit by apprenticeship sponsors:

- (1) the credit arrangements are negotiated nationally rather than by local apprenticeship programs on college-by-college basis;
- (2) course offerings are available through delivery on-line through the internet;
- (3) the new efforts go beyond Associate (two-year) degrees, making available to apprentices a variety of college degrees, including Bachelor's (four-year), and Master's (postgraduate) degrees in technical and non-technical majors; and
- (4) the opportunities for college credentials are being organized for apprentice instructors as well as apprentices.

Apprenticeship sponsors commonly provide discounts on tuition, scholarships, and other forms of subsidy. These arrangements, together with the built-in "earning while learning" feature of apprenticeship, make postsecondary education more affordable and accessible to construction workers.

Augmenting apprenticeship with college learning and educational credentials benefits individual workers as well as the industry as a whole. College degrees provide apprentices access to opportunities to move ahead in their careers, such as assuming foreman or superintendent responsibilities. At the same time, it adds status to the trades and facilitates recruitment of new applicants to the industry, an especially important feature in tight labor markets. For the nation, this practice is also beneficial because it can lead to a more "seamless" education and training system.

Scholarship-loan agreements

Multi-employer collective bargaining and the establishment of trust funds have helped the union sector to deal with the challenge of under investment in training by employers. However, these mechanisms do not totally resolve the problem of training investments walking away when workers leave to work for firms that are not signatory contractors. Thus some trades have sought other means to attempt to assure

returns on their investment. One of these is the "scholarship-loan agreement", which is widely used for training in the sheet metal and air conditioning industry.

The "scholarship-loan agreement" is a contract that protects investments in training and education made by the industry. The concept was initially implemented by the US Navy shortly after the Second World War as a way of protecting its investment in college assistance provided to enlisted personnel. The Navy agreed to pay enlisted personnel a stipend to attend college in return for signing a commitment to serve in the Navy for a period of years.

The sheet metal and air conditioning industry adapted the concept, calling for all individuals entering training paid for by the industry to sign a "scholarship-loan agreement" contract. According to this contract, the trainee agrees prior to entering training to stay with the training sponsor for a given number of years (up to ten years depending on the expense and nature of the training) so that the investment in training can be recouped, or pay back a portion of the funds invested in the training on an annual pro-rata basis. Although the scholarship-loan agreement has been enforced in court successfully, its "threat value" is likely far more important than actual court enforcement. Anecdotal evidence and testimonies from industry officials have indicated that scholarship-loan agreements have reduced turnover rates; however, no careful quantitative studies are yet available to validate this claim.

Defending the term "apprenticeship"

With several hundred million dollars that building trades annually invest in training, construction apprenticeship sponsors tend to take a proprietary perspective of their training. They view training as their competitive edge in a very competitive industry.

In the early 1990s, proponents called for establishing a vast expansion of "youth apprenticeships" which is the wording used in early versions of the proposed School-to-Work Act of 1994. These proponents had noted all the advantages of apprenticeship for youth development, including built-in mentoring arrangements, earning while learning, and a learning environment that appeals to youths weary of school. Inspired by examples of apprenticeships in Germany, Switzerland and Denmark, they saw in the apprenticeship concept an ideal means to help smooth the transition from school to work (Hamilton, 1990).

Union-management registered apprenticeship sponsors strongly resisted the term "youth apprenticeship", arguing that what was being proposed was a violation of the term "apprenticeship" and a dilution of its meaning. They argued that "apprenticeship" should be limited to registered apprenticeship exclusively. Their insistence illustrates the stakes of unions in apprenticeship training. It is often claimed that the union interest in apprenticeship is due to the motive to control the supply of labor. Given the multitude of ports of entry into the industry, this is unlikely to be the case because it is hardly effective. Rather, apprenticeship permits trade unions some control over the quality of labor and helps protect jurisdictional boundaries between trades. As a result of the objections raised by registered apprenticeship sponsors, use of the term "youth apprenticeship" was dropped and "school to work" (or more recently, "school to career") became the name for this initiative.

Non-union efforts to address under-investment in training

The non-union sector in construction has taken a different strategy to promote training its workforce. In 1995 11 large national construction companies and several national contractor associations established the National Center for Construction Education and Research (NCCER) as a non-profit education foundation at the University of Florida "to address the severe workforce shortage facing our industry and to develop standardized construction, maintenance, and pipeline curricula" (NCCER, 2004a). The NCCER has developed curricula, assessments, and certifications for 22 construction specialty skill areas and, in collaboration with the American Petroleum Institute, another 15 specialty skill areas in pipeline installation and maintenance. NCCER training curricula and assessment materials are now generally considered as the technical training standard in the non-union sector of industrial construction. In addition, NCCER maintains for construction employers an electronic National Registry of individuals who have been assessed and certified. Statistics available as of November 1, 2004 indicate that 62,007 assessments had been taken in construction crafts and an additional 50,914 in pipeline crafts. No data were available on how many passed (NCCER, 2004b).

Through a partnership with Pima Community College in Florida, craft trainees can earn college credit for successful completion of NCCER's Construction and Maintenance Curricula when administered through NCCER's Accredited Training Sponsors (NCCER, 2004c).

To fund training programs, the NCCER has established a National Training Service Agreement (NCCER, 2004d). A participating contractor voluntarily contributes 15 cents per craft labor hour worked to an individual account that NCCER establishes and maintains for the contractor. Of the hourly contributions, 13 cents are available to be reimbursed to the contractor on submission of appropriate invoices for training expenses. The remaining 2 cents are used for national activities, such as curriculum revision, maintenance of the National Registry, and program development. The NCCER service provides third-party verification to construction owners that the contractor is conducting training.

While participation in the NCCER initiative has been slow to advance beyond the original founding companies and their subcontractors, it remains too early to judge whether this effort will be successful in raising the industry's level of investment in construction training.

Conclusion

The current US apprenticeship system remains largely concentrated in the construction industry. Using recent data on registered apprenticeship, the paper compares the performance of building trades programs sponsored with and without the participation of unions. Apprenticeships with union participation were found to have much higher enrolments, greater share of women and ethnic/racial minorities. These programs also have a markedly better performance for all groups on rates of attrition and completion.

Joint apprenticeship programs in the building trades remain vital and continue to improve, as demonstrated by recent accomplishments, such as the establishment of national training funds and national instructor preparation, arrangements for college credit for learning in apprenticeship, and expansion of journey-level update training.

Yet significant challenges remain ahead. A growing US construction industry faces the need to address shortages of skilled workers. The high level of dropouts in training complicates the problem. In our sample, fully 60 percent of apprenticeships overall were cancelled and a large portion of these were cancelled early in the apprenticeship before significant skill acquisition could occur. Also, by avoiding hiring women, the industry limits its available pool of applicants.

The non-union sector has not trained its share of registered apprentices, nor has it performed well in graduating craft-workers. Given past performance record of non-joint apprenticeship, the future does not bode well. To date, the non-union sector has not established effective mechanisms to address the reluctance of employers to invest in training in the face of transient construction labor markets.

The challenge for the USA is to devise incentives for institutional mechanisms to cope with skill shortages in the construction industry. Adaptation of the "scholarship-loan" concept and combining college credit with apprenticeship training offer promising approaches to remedying under-investment in training by employers. The NCCER National Training Service Agreement offers another approach. However, it is likely that further efforts will be required.

Notes

1. Registration costs run about \$150 per apprentice. In addition, some states partially finance the delivery of related instruction. In some localities, preparatory programs for disadvantaged workers or persons under-represented in apprenticeship are conducted with public funding.
2. These states are: Alabama, Alaska, Arizona, Arkansas, Colorado, Florida, Georgia, Idaho, Illinois, Indiana, Iowa, Michigan, Mississippi, Missouri, Montana, Nebraska, Nevada, New Jersey, New Mexico, North Dakota, Ohio, Oklahoma, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Utah, West Virginia, and Wyoming.

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