



THE NEXT GENERATION OF HVACR INSTALLERS AND TECHNICIANS:

What Instructors are Saying and What Needs to be Done About It

HVACR
WORKFORCE DEVELOPMENT
FOUNDATION

HVACR Workforce Development Foundation
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■ ABOUT THE HVACR WORKFORCE DEVELOPMENT FOUNDATION ■

The HVACR Workforce Development Foundation is dedicated to leading an industry effort to develop and promote educational projects, programs, and partnerships to attract committed and skilled employees to a career in HVACR.

The Foundation's objectives are to raise the awareness of the HVACR industry and the importance it plays in daily lives; create interest in the HVACR industry as an attractive and profitable career choice; and to enhance the quality and quantity of available workforce for the HVACR industry.

A list of board of directors and funding organizations can be found at the end of this report. The HVACR labor analysis reports were funded by the Foundation, with additional support from the Air-Conditioning, Heating, and Refrigeration Institute.

More about the Foundation, along with PDFs of this report, the two companion reports, along with the executive summary and infographic, can be found at www.CareersinHVACR.org.

Contact the Foundation at info@HVACR-WDF.org

■ THE NEXT GENERATION OF HVACR INSTALLERS AND TECHNICIANS ■

What Instructors are Saying and What Needs to be Done About It

INTRODUCTION

No matter the weather conditions, whether stifling hot or frigidly cold, air conditioning, heating, refrigeration, and hot water are considered necessities to sustain human, animal, and plant life. These technologies are often taken for granted until something goes wrong. From homes and offices to school and hospitals, private or commercial transportation to shopping malls and sports and entertainment complexes, residents in the United States and Canada are accustomed to the comfort of these environments.

A new study commissioned by the HVACR Workforce Development Foundation found that the industry that provides heating and cooling and environmental safety is on the cusp of being severely affected by a crisis in the supply of technicians and mechanics to install and maintain the life-saving and comfort-creating equipment that people everywhere depend on every day. Employers in the Heating, Air Conditioning, Ventilation, and Refrigeration (HVACR) industry have serious concerns; they cannot fill the jobs that exist today in the HVACR industry. And when they project their need for workers into the next decade, by any measure they are confronting an escalating employment crisis.

Even though educators do their best to adequately train installers and technicians to work in the HVACR industry, an online survey of instructors found that they face an increasingly thorny mixture of obstacles and challenges. For example, because many students are unaware of the profession and its solid middle-class salaries, recruitment is difficult. Unfortunately, once students are enrolled in a program, educators reported that many of them are not academically qualified, particularly in the areas of science, technology, engineering and mathematics (STEM) or reading. In addition, their soft skills, e.g., life/social skills and critical thinking, are often lacking as well.

In the policy arena, a maze of certification, licensure and apprenticeship requirements compound the difficulties of streamlining curricula to match a uniform set of requirements. These prerequisites often vary widely state-to-state in the U.S. and province-to-province in Canada, decreasing the potential mobility of workers. Finally, many educators reveal that they do not feel completely current with the workforce demands of HVACR industries.

This crisis presents an opportunity for employers and instructors to familiarize themselves with these findings and formulate a plan before the situation becomes dire. By studying the complexities of the increased job demands and a lack of trained employees, HVACR trade associations and their members can work in tandem with policymakers, school administrators, educators, and parents and students to build a robust, qualified workforce.

PURPOSE OF THE STUDY

To determine the extent of the problem and potential solutions, the HVACR Workforce Development Foundation commissioned a survey to assess the training and education of students entering HVACR jobs in the U.S. and Canada. This study confronted myriad intersecting issues and questions; the researchers sifted through complex information to distill it into a coherent whole. This

HVACR jobs are STEM jobs.

Behind every refrigerator, every furnace, every air conditioning system, every vent, every freezer, and every water heater is a well-trained technician installing, servicing, and maintaining the intricate infrastructure that maintains human life and simple comfort. Until something goes wrong, most are unaware that these supports require human expertise and skill.

report complements two other reports released simultaneously: *Heating up: Sweltering Demand for HVACR Workers* by Burning Glass Technologies and *A Labour Market Investigation of the HVACR Sector*, prepared by Prism Economics and Analysis, both with funding provided by the HVACR Workforce Development Foundation. The full reports can be found at www.careersinhvacr.org.

Three research questions focused the research design. These questions are the major levers that influence the supply of students qualified for highly skilled HVACR employment: preparation, policies, and collaboration between training institutions and employers. This analysis is not meant as a best practices report, but as a general overview of current education and training programs.

THE FOLLOWING QUESTIONS FRAMED THE SURVEY AND ANALYSIS:

1 To what extent do secondary and post-secondary educational programs adequately prepare a sufficient number of students for HVACR employment in the United States and Canada? What are the particular challenges that affect program quality, and what strategies could address them?

2 In what ways do key policies influence adequate student preparation for HVACR careers (e.g., accreditation, certification, licensure, and apprenticeships)? What actions taken by practitioners and policymakers could streamline, focus and improve these policies to ensure an adequate workforce?

3 In what ways could training institutions and HVACR employers improve collaboration with each other and/or strengthen existing efforts to ensure a steady pipeline of qualified workers through targeted recruitment, strong retention plans, and ongoing program evaluation?

METHODOLOGY

The Executive Director of the HVACR Workforce Development Foundation worked with Lockwood Education Analysis Consulting to construct an electronic survey using SurveyMonkey. The survey contained 39 questions with an additional concluding question inviting respondents to provide contact information for any follow-up interviews with the researchers.

The online survey was activated in March 2015. The initial respondents were instructors and educators at two annual training conferences, respectively: the HVACR & Mechanical Conference for Education Professionals (March 9-11, Baltimore, MD), which was hosted by the HVACR Workforce Development Foundation; and the HVAC Excellence Educator and Trainers Conference (March 15-17, Orlando, FL), hosted by HVAC Excellence. Following the initial launch at the two conferences, a letter of introduction containing a link to the online survey was emailed to targeted lists of instructors responsible for HVACR education in secondary and post-secondary institutions in the U.S. and Canada (the initial and follow-up messages were sent between March 20 and April 13, 2015).

Organizations that provided e-lists for the survey included:

1. The National Council of Local Administrators of Career and Technical Education.
2. Skills USA, with an extracted list of instructors and administrators of HVACR, plumbing, and appliance repair programs
3. North American Technician Excellence (NATE)
4. The Heating, Refrigeration, and Air Conditioning Institute of Canada (HRAI)
5. The Council of Air Conditioning and Refrigeration Educators (CARE)
6. The Partnership for Air-Conditioning, Heating, Refrigeration Accreditation (PAHRA)
7. Past attendees of the HVACR & Mechanical

Educators annual conference for years 2010-2014. These highly targeted email lists were provided by professional organizations of HVACR instructors and administrators at the secondary and post-secondary level. The combined lists totaled approximately 2,707 potentially eligible respondents with possible duplication amongst the lists.

An additional list of 1,206 educators in HVACR programs was purchased from Market Data Retrieval (MDR), a reputable private list broker in the educational sector. The brokered list from MDR stood apart from the lists provided by professional associations with a much lower response rate; according to the metrics provided by MDR there were 40 click-throughs. This leads us to hypothesize that the MDR list did not, in large part, reach the intended recipients of HVACR instructors and administrators.

Social media was also used to assist with awareness of the survey. An invitation was posted to the HVAC Instructors Forum on LinkedIn, a group formed and moderated by HVAC Excellence. Also, The ACHR News, an industry trade publication, included a brief article in its online and print editions.

The combined email lists totaled 3,913 potential respondents. When the survey closed on April 15, 2015, there were 590 total responses, a response rate of 15 percent. After the initial question on eligibility to continue with the survey, 544 instructors continued with the majority completing the entire online survey including answering extensive open-ended questions. While respondents were able to select which questions they answered, 320 finished the survey and opted in or out of the drawing for a gift card. Overall, the responses provided from the total aggregate of lists were robust and more than sufficient to draw inferences.

ANALYSIS OF SURVEY RESPONSES

Based on the responses from the survey questions, an in-depth analysis was conducted of the five survey sections that included 1. Characteristics of programs, instructors and students; 2. Quality of curricula and instruction; 3. Accreditation, certification and licensure of programs; 4. Professional development for instructors; and 5. Marketing and recruitment strategies.

1. CHARACTERISTICS OF HVACR PROGRAMS, INSTRUCTORS AND STUDENTS.

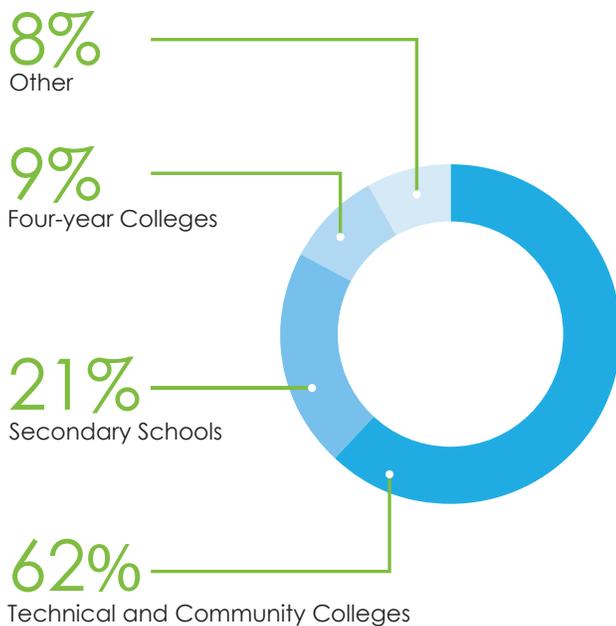
The first section of the survey focused on the features of the HVACR programs followed by characteristics of instructors and students designed to provide a comprehensive profile, including projected supply of new employees.

HVACR Programs. Since 95 percent of all survey respondents teach in HVACR education and training programs, the study has a strong base for overall analysis. Two-thirds of instructors (62 percent) reported that they work at technical or community colleges, while 9 percent indicate they work at a four-year college or university. Instructors at secondary schools accounted for 21 percent of survey takers.

The remaining participants (8 percent) reported that they provide HVACR training in programs sponsored by contractors, wholesale distributors, unions, and corporate training programs as well as the Federal Bureau of Prisons and other correctional facilities. This is a significant area of training that warrants further study for a number of reasons, including the possibility of scaling up these programs. Further investigation could discover elements about program characteristics that match and differ from other training programs, identifying ways in which entities could collaborate to ensure a uniform curriculum. Respondents in Canada were similar to those in the U.S. in secondary and post-secondary institutions, but had a higher percentage of corporate and industry trainers (one-third).

Next, the geographic locations of HVACR programs were reviewed. Survey respondents were asked to enter the name of their institution and state/province in an open-ended question. The majority of instructors who took the survey were located in institutions east of the Mississippi River. There were only three states west of the Mississippi with significant response rates: California, Oklahoma, and Texas, which coincidentally are known to have well developed HVACR programs. Three states had no survey participation: Hawaii, Wyoming and Vermont. Both the District of Columbia and Puerto Rico had two responses. Instructors from

INSTRUCTORS' INSTITUTIONS



Manitoba and Ontario also responded to the survey. With such a range of states and provinces responding to the survey, there was sufficient geographical breadth to make informed inferences for this report.

APPROXIMATELY 163 SEPARATE TECHNICAL AND COMMUNITY COLLEGES WERE INCLUDED IN THIS SURVEY

When examining the number of instructors who voluntarily entered the name of their institution (and by deleting duplicate responses within an institution), the authors were able to deduce that approximately 163 separate technical and community colleges were included in this survey. Because most respondents were teachers or administrators in public or private technical or community colleges, they compared this list against the U.S. Department of Education which indicated in 2007 there are 436 public and private schools offering two and less-than-two year degrees in this field (<http://www.nces.ed.gov/surveys/ctes/tables/P87.asp>). This indicates that 37 percent of the total of known HVACR technical and community colleges in the U.S. with HVACR programs had instructors who completed this survey. These figures were used to make projections about the future supply of HVACR technicians and mechanics. In Canada, responses were evenly divided between instructors at secondary and post-secondary schools and other training entities.

A comprehensive and reliable list of all secondary and post-secondary programs offering HVACR programs in the United States would be a significant contribution to the knowledge base; a list does exist for Canada. It would also be invaluable to have a similar list of all training programs and their characteristics that are provided by contractors, wholesale distributors, unions, and corporations. The researchers were able

to compare the locations provided by respondents against a database of HVACR programs in the U.S. and Canada maintained by the HVACR Workforce Development Foundation (<http://www.careersinhvacr.org/site/292/Careers/Find-a-School>).

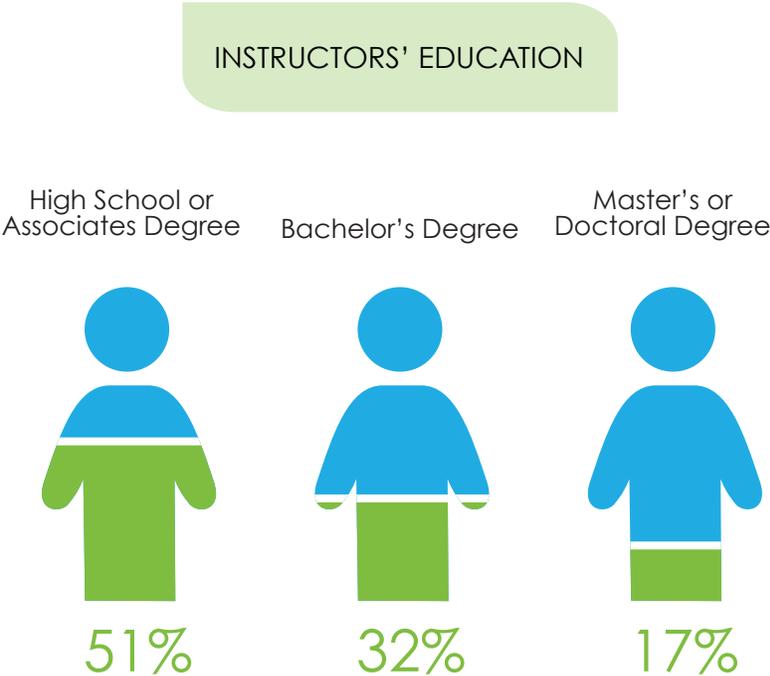
While by no means complete, the Foundation's online list is comprised of mostly post-secondary schools offering HVACR courses, listed alphabetically by state and then province. The entities that are listed include public technical and community colleges along with four-year colleges; private technical colleges; other training organizations such as occupational/ adult educator centers and correctional facilities; and union, industry, and corporate training facilities. While acknowledging the limitations of the Foundation's list of institutions, when that list of educational entities was cross-referenced with the number of survey respondents by states and province, the numbers were very similar. It should be noted that the Foundation's database does not include individual email addresses for instructors so this list was not included in the email dissemination of the survey that used other lists.

FACULTY MAY FIND THEMSELVES SPREAD THINLY TO AN ALARMING DEGREE

Characteristics of Instructors. Educators and administrators at these institutions play a key role in preparing future HVACR technicians and mechanics. The vast majority (approximately 78 percent) identified themselves as full-time instructors in an HVACR program compared to 10 percent who self-identified as part-time/adjunct instructors with a small number (8 percent) who categorized themselves as only administrators. All but one of the Canadian respondents was a full-time instructor. Some respondents added comments about their extended roles: they acted as both instructor and administrator for their programs.

Instructors were asked how many educators taught in their programs. The number fluctuated from one to forty; with secondary schools averaging 1.5 instructors per program. Post-secondary schools and colleges had slightly more instructors with an average of 5. The small size of professional educators in the majority of degree programs raises concerns about possible isolation and lack of collegial input. Faculty may find themselves spread thinly to an alarming degree, working as both instructor and program administrator, as some indicated. When adding responsibilities for marketing a program and recruitment of students, the quality of instruction can be diminished due to simple lack of time. Manufacturing, industry and union training programs reported the most trainers. The researchers hypothesize this is due to the nature of the number of certifications they offer hence the number of trainers needed for intensive short workshops/ classes, since these programs generally do not lead to degrees.

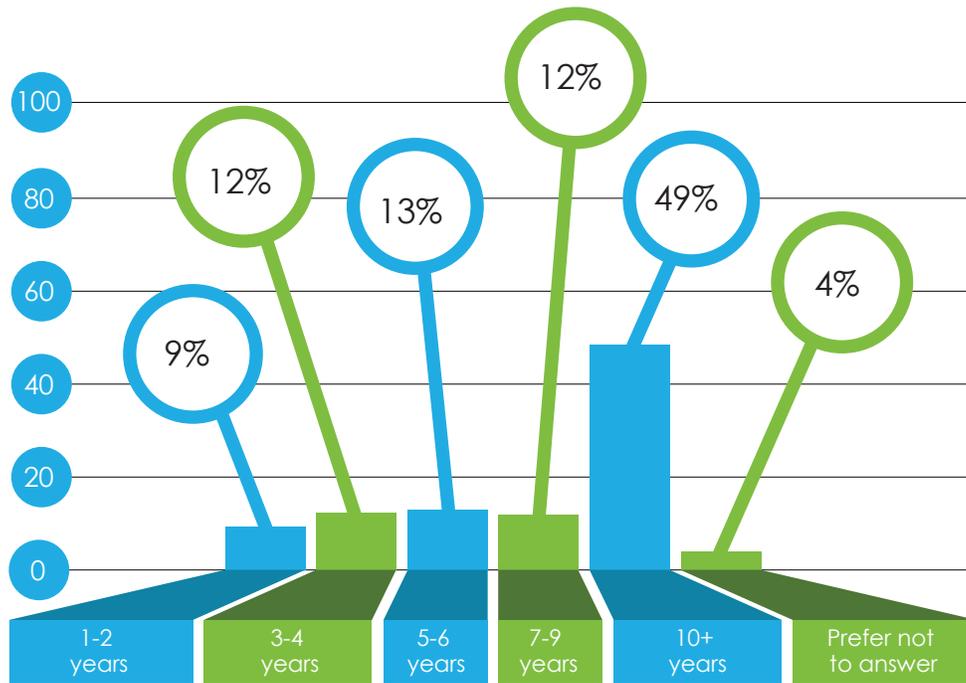
Approximately 51 percent of respondents reported that they hold a terminal degree at the secondary or associates level, 32 percent have a bachelor's degree, and 17 percent have a master's or doctoral degree. This is compared to instructors in Canada, where 33 percent had a secondary school or associate's degree and 66 percent had a college, Master's or higher degree. Over 100 comments left by respondents provided additional information, such as extensive years of work experience including formal apprenticeships; possession of state/province contractor's licenses; and a terminal educational level other than a degree, such as a high school diploma or its equivalent. Some instructors noted that in addition to their teaching responsibilities they are enrolled in an associates or four-year college degree program to increase their own technical and classroom skills and/or to gain a state teaching license. Other instructors specifically mentioned taking non-traditional coursework that leads to alternative teaching certification—an area with implications for both policy and practice.



Almost 50 percent of U.S. respondents and 70 percent of those in Canada indicated that they will retire within the next 10 years, a rate considerably higher than for the workforce as a whole. The Social Security Administration estimates that 22 percent of the current total U.S. workforce will retire by 2022, which is only seven years away. (<http://www.socialsecurity.gov/performance/2012/APP%202012%20508%20PDF.pdf>).

These pending retirements indicate an urgent need for in-depth, sustained professional development for the remaining instructors and those who will be hired to replace the retirees. Thus professional development needs to focus on the requirements of the workplace so that instructors can feel adequately prepared for the rapid workforce changes and demands.

HOW MANY YEARS UNTIL YOUR ANTICIPATED RETIREMENT?



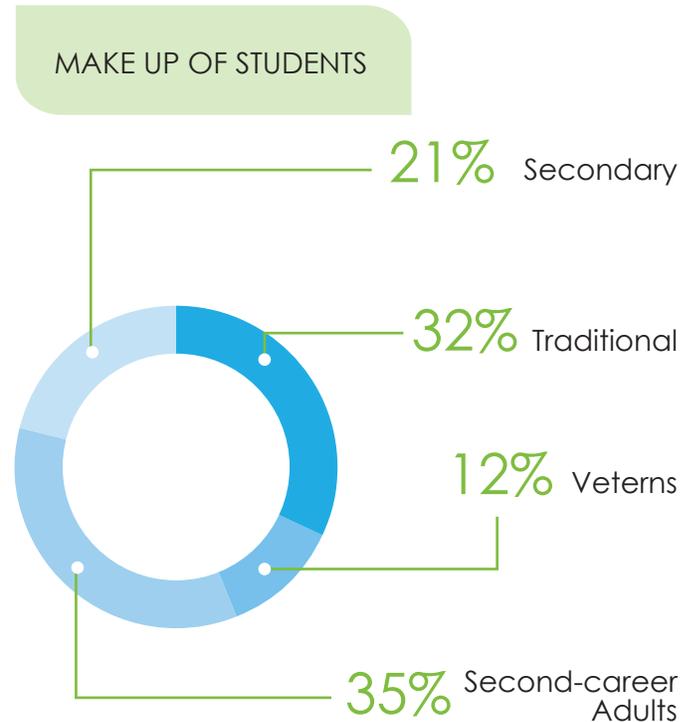
To better understand the state of secondary career and technical education (CTE) and HVACR programs, the Institute for Education Sciences (IES) at the U.S. Department of Education released a series of reports in 2009, the most recent year available. One of the studies tracked the main teaching assignments of all teachers in grades 9 through 12 at both regular and career/technical high schools. IES researchers divided CTE teaching assignments into ten CTE program areas, with nine percent of CTE teachers falling into the construction, architecture, and engineering technologies program area. The IES analysis found that the average age of a CTE teacher is 44, while a teacher in the construction cluster is five years older (www.nces.ed.gov/surveys/ctes/tables/index.asp?LEVEL=SECONDARY).

While this CTE category is broader than just HVACR classes, it offers a proxy to compare against the survey findings in this report and to gauge the number of students feeding into the pipeline. On average, fewer students are taking any type of CTE classes in secondary schools; there is an absence of any information that indicates this information has changed in the past seven years in a positive direction. A reason for the decrease may have implications due to federal policies such as No Child Left Behind, the legislation governing public schools in the U.S. These statistics seem to indicate that students continuing from high school into post-secondary programs might be less prepared in, or aware of, HVACR-related skills than they were in the past.

MARKETING AND RECRUITING STRATEGIES THAT COULD BRING QUALIFIED STUDENTS INTO HVACR PROGRAMS

Instructors listed a host of challenges facing their programs. Some challenges were structural, such as lack of classroom/lab space and insufficient equipment and materials. Others included a lack of prepared and

motivated students and relationships with prospective employers that needed to be strengthened. They also pointed to problems with marketing and recruiting



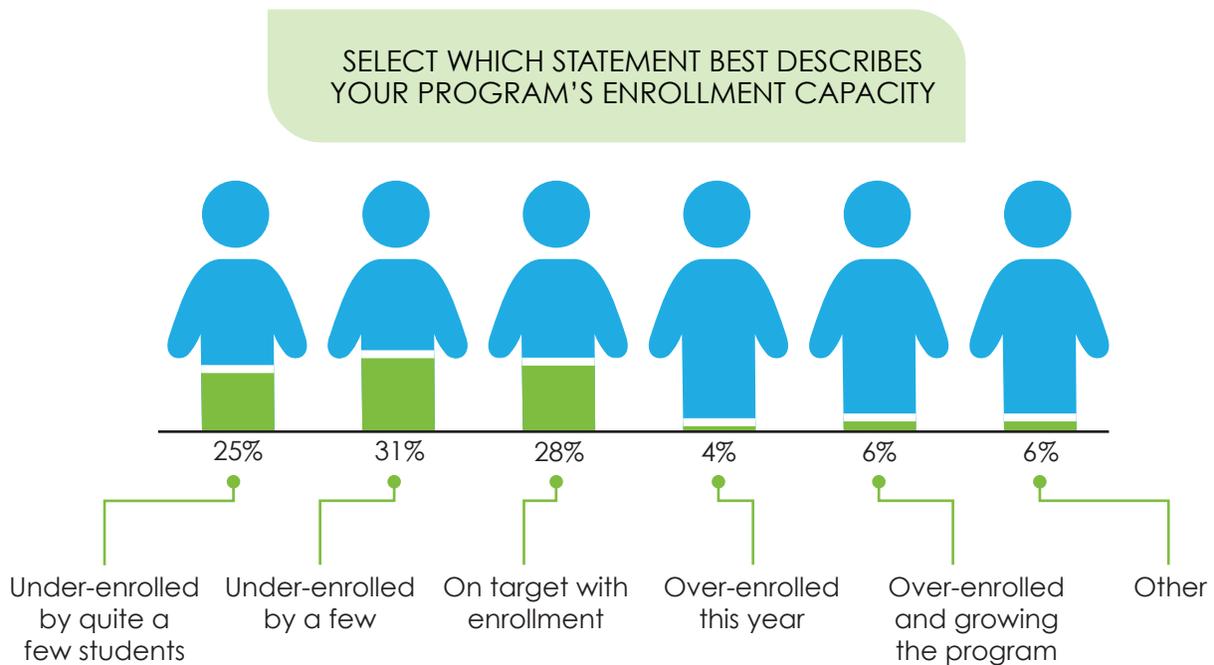
strategies that could bring qualified students into HVACR programs. One can surmise that programs with very few instructors would struggle with the many challenges they confront. Instructors who must teach but also recruit students, market their programs and struggle to develop relationships with employers are severely over-extended.

Student Characteristics. To gain an understanding of students currently enrolled in HVACR programs, several questions probed into multiple student characteristics so that respondents could provide a composite portrait of their students. As noted above, a fifth of the instructors who took the survey teach in secondary schools. Over two-thirds reported on students enrolled in HVACR programs in public and private community or technical schools and four-year colleges, while eight percent were affiliated with union, manufacturing, and

corporate training programs. One-third of enrolled students were described as “traditional,” meaning those who had graduated with a degree or GED from a secondary school in the recent past. The remainder of enrollees were veterans or members of the National Guard (12 percent) or second-career adults seeking new skills (35 percent). This significant percentage of second-career adults included the unemployed or underemployed in search of new careers. Canadian respondents noted that they had no veterans in their programs.

anticipated dropouts, and several complained they could not accept any more students because of the lack of space for classrooms and laboratories.

Instructors reported that the biggest challenge facing them is unprepared students. They list a variety of problematic areas: “lower skill level than prior years,” “poor study habits,” and “poor reading, math, and comprehension skills.” Several respondents pointed to a lack of motivation and work ethic at secondary and post-secondary levels, as well as spotty attendance.



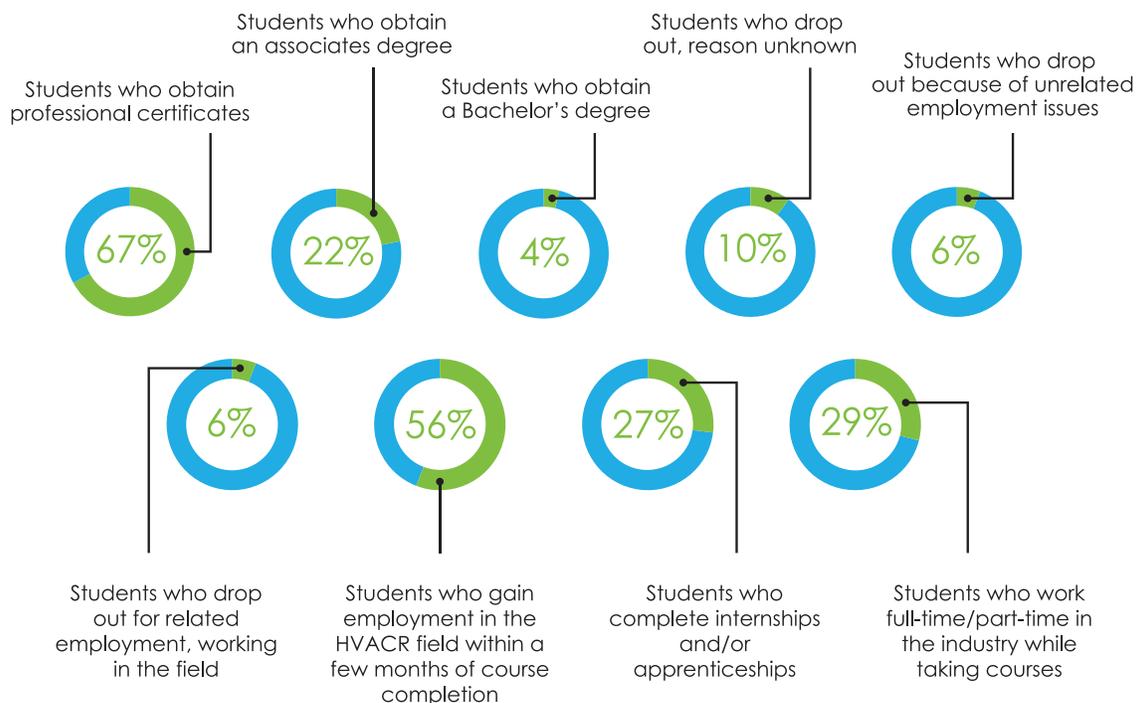
It is striking that more than half of HVACR instructors and administrators in both the U.S. and Canada (56 percent) report that their programs are under-enrolled with room for more students. A little over a quarter (28 percent) are on target with their enrollment, while 10 percent are over-enrolled. A number of respondents left comments to further expand on their answers. A few noted they had waiting lists for their programs, while two replied that their programs were too new to gauge enrollment. Others reported that their programs were deliberately over-enrolled because of

In fact, the level of students’ basic skills attainment, particularly in reading and math, is a major concern for instructors. Of course, the foundation for these skills should be formed in the elementary and middle grades, but secondary schools play a role as well. If ill-prepared students enter post-secondary HVACR programs, instructors will spend a disproportionate amount of instructional time on remediation—something they may not be trained to do. This time also dilutes the quality of instruction for other students.

A number of survey takers noted difficulty finding students with clean driving records, the ability to pass drug tests, and prevalence of tattoos on arms, neck and face. The issue of drug use appears to be a major concern among instructors and we can reasonably infer it would be among employers as well. A few respondents named student cell phones as an inhibiting factor on classroom instruction, with an instructor calling cell phones an “obsession” with students. Others specifically bemoaned the lack of women and minorities in their programs—an issue that needs to be addressed in recruiting efforts.

The apparent lack of student preparation and motivation also strongly influences student retention once enrolled in HVACR programs. Instructors stated that approximately 22 percent of matriculated students dropped out of programs for unknown reasons or because they found employment not related to their training. They also stated that almost 30 percent of students were working in the profession while attending classes or in an apprenticeship program, thus already in the workforce. According to the instructors, 56 percent of students in HVACR programs gained employment within a few months of course and program completion.

STUDENTS' OUTCOMES IN HVACR TRAINING PROGRAMS



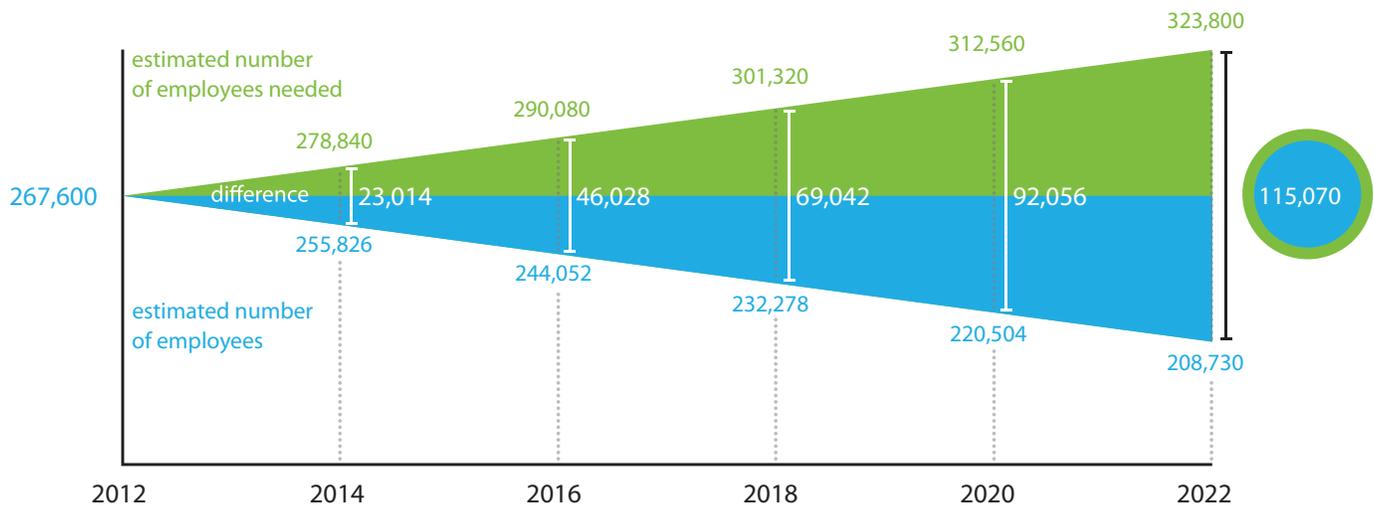
Supply of HVACR Installers and Technicians. The number of students enrolled in secondary and post-secondary institutions has powerful implications for HVACR employers. If the supply is insufficient for the demand, clearly the overall impact on a strained or insufficient workforce will be severe. As companion reports to document the demand side of HVACR jobs from Burning Glass Technologies and Prism Economics and Analysis (www.careersinhvacr.org) indicate, this supply side analysis indicates a dearth of trainees to fill the HVACR jobs caused by new sector growth, competition from other industries, and retirements over the next decade and beyond. To fill these highly skilled positions, secondary and post-secondary schools and other training entities must keep pace with a steady supply of career-ready students.

of over 115,000 new technicians need to be trained by 2022 to meet the anticipated demand. Current supplies are nowhere near meeting this demand.

THE OVERALL IMPACT ON A STRAINED OR INSUFFICIENT WORKFORCE WILL BE SEVERE ”

Where will these highly trained new employees come from to fill this workforce gap? As the other companion reports have indicated, the demand for HVACR jobs is growing at a rate exceeding other middle-skill jobs, but we know that the number of HVACR programs at secondary and post-secondary schools are decreasing. The number of students graduating with relevant degrees is also declining

PROJECTED WORKFORCE GAP FOR HVACR TECHNICIANS BY 2022



According to the U.S. Bureau of Labor Statistics (BLS), in 2007 there were 267,600 HVACR mechanics and installers the labor force with an estimate of growth of 21 percent by 2022, which is faster than the national average (<http://www.bls.gov/ooh/installation-maintenance-and-repair/heating-air-conditioning-and-refrigeration-mechanics-and-installers.htm>.) As stated earlier, the Social Security Administration estimates an overall retirement rate of 22 percent, thus an estimate

in post-secondary programs. According to the USED from 1997 to 2006 the number of associates degrees conferred upon students for the broader category of manufacturing, construction, repair and transportation declined from 37,259 to 31,285 or 16 percent. Using the most up-to-date data available (2012), the number dropped to 28,564 or by 23 percent in the past 15 years (http://nces.ed.gov/programs/digest/d13/tables/dt13_318.50.asp).

Based on the responses from this survey of HVACR instructors, secondary school teachers who responded (21 percent) have between 4,093 and 4,667 students enrolled this school year; this includes students primarily in grades 11 and 12 and who may or may not pursue further education in this trade. While this is an underrepresentation, an accurate range cannot be extrapolated without knowing the number of secondary programs. Employers will be the arbiter of whether or not these students are tool-and-diagnostic-ready to meet the demands of fulltime employment with or without additional training. Some students from dual enrollment programs, where they take courses at a technical or community college while in high school, may be ready to enter the workforce.



The instructors taking this survey at four-year public or private colleges (nine percent) teach between 685 to 770 students who are working toward a bachelor's degree related to HVACR. While some of these students may pursue a technician or mechanics position, we can hypothesize that the majority of them will use their four-year degrees and work for engineering firms, manufacturers, or other employers where jobs require a college degree so accordingly should not be included in the direct-to-job supply chain for skilled workers.

In this study, students enrolled in training programs offered by unions, manufacturers, wholesalers and distributors are already in the workforce and thus counted as employed and not new to the profession. This constitutes nine percent of respondents and upon further clarification the bulk of these "students" are already in the workforce and thus counted in the employment numbers. This distinction is critical and affects the supply side. Many in this category are attending on-going professional development workshops, seminars, webinars, and conferences to keep current with new technology and new

regulations; to become certified or to re-certify; in an employee-sponsored apprenticeship program; or need to take continuing education credits to retain contracting licenses. This is an area for future research in anticipation of training programs that assist in the supply of new as well as current employees.

The remaining 62 percent of respondents teach at the technical or community college level, the training ground for new employees being sought by HVACR companies. Of the respondents to this survey, instructors indicated there were between 13,253 to 15,178 students enrolled in school year 2014-2015, although not all of them are prepared for full-time employment. When extrapolated to include the full spectrum of two-year institutions offering associates degrees, the estimated range of enrolled HVACR students is between 35,316 to 40,548, the midpoint is 37,932 for reasons of our calculations below. Based on this range, it is possible to calculate the number of students who will gain fulltime employment, or become employed after completing a HVACR program. In 2015, an estimated 21,239 new employees are qualified to enter the workforce from technical or community colleges. These new technicians and installers will fill the jobs that are open due to retirements, attrition, competition, and new growth in the industry.

If schools do not recruit and retain more students; if parents do not encourage their children to explore this profession; if administrators do not add programs, but cut them; if training organizations and unions decline; if the current industry doesn't convey their need; and if traditional students, veterans, and second-careered adults are not encouraged to pursue this middle-class highly skilled profession, then in less than seven years there will be not be sufficient new entrants to the HVACR pipeline to meet future demands.

Based on this new information, it is clear that the HVACR industry needs a North American plan to address the declining supply of a highly-qualified workforce combined with the increasing demand for HVACR jobs. Without an intentional plan to address a relevant, up-to-date curriculum, the quality of recruitment practices and students, and how to convince guidance counselors, students and parents of the changed perception of the job the industry will continue to lose employees to retirement and competitors, and not be able to fill those positions as well as supply for new growth.

RESPONSES HOVERING AT
APPROXIMATELY
50% INDICATE
FOR PROGRAM IMPROVEMENT A NEED



2. QUALITY OF HVACR PROGRAMS

In the next section, participants were asked to rate their programs on a discrete set of characteristics, using a four-part Likert scale that ranged from “satisfactory” to “unsatisfactory.” In one interesting finding, respondents were twice asked to rate curriculum alignment with workforce requirements. The first time they rated this, 75 percent checked “satisfactory,” but later, that percentage dropped by ten percentage points, perhaps indicating a bit more honesty as they became more comfortable taking the online survey.

Program-level strategies to help students get jobs were given a “satisfactory” rating by only half of the respondents, and only 58 percent rated ongoing relationships with employers as “satisfactory.” When asked if the number of internships and apprenticeships was adequate, only about 35 percent responded that it was satisfactory; this was higher in Canada where apprenticeships programs are much more formalized. Three-quarters of instructors marked satisfactory indicating the curriculum was aligned with workforce requirements. However, responses hovering at approximately half indicate a need for program improvement.

3. ACCREDITATION, CERTIFICATION, AND LICENSURE ISSUES

Program accreditation and teacher and student certification and licensure are a very complex mixture of requirements that often overlap or contradict as indicated in the third section of the online survey. Further evidence of this was provided by survey respondents.

Accreditation. Responses pointed to the importance of HVACR program accreditation. This is easily understandable; accreditation by a respected entity increases program credibility. Less than half of respondents indicated they worked in accredited programs. For those programs that do hold a nationally recognized accreditation from a granting entity it was fairly divided between HVAC Excellence (19 percent), NCCER (15 percent), and PAHRA (12

LESS THAN HALF
OF RESPONDENTS
INDICATED THEY
WORKED IN ACCREDITED PROGRAMS



percent). Some respondents also noted in the comments section that their parent institution was accredited, but this doesn't indicate the quality of the HVACR program. Thirty-nine percent of respondents indicated their program had no accreditation of which they were aware. While it is beyond the scope of this study to examine the complexities of accreditation, this is an indicator for future investigation.

Instructor Certification and Licensure. As in other fields, certification of HVACR instructors is intricate. While a few types of certifications are common, what is required in one state may differ considerably in another. In a 2007 report from the National Research



Center for Career and Technical Education that focused on state certification and licensure requirements for secondary CTE, the authors examined the credentialing of career and technical educators in all fifty states and the District of Columbia (Zirkle, Martin, & McCaslin, 2007), (<http://www.nrccte.org/resources/publications/study-state-certificationlicensure-requirements-secondary-career-and>).

Zirkle, Martin, & McCaslin scrutinized both traditional, degree-based program requirements for licensure as well as alternative pathways. They concluded, not surprisingly, that requirements for CTE teachers varied widely among states. The overwhelming quantity and variety of qualifications for CTE teaching licenses did not permit the construction of an inclusive list of requirements. The authors further concluded that the lack of a thorough list of licensure requirements was a serious problem in the U.S. The report notes that CTE instructors, particularly in the construction and trades and health care programs, usually are not required to meet traditional teacher licensure requirements, due to the heavy experiential component of their programs. While HVACR instructors at the secondary

level may not be required to follow the traditional pathway of core academic and CTE teachers, they are expected to possess sufficient overall knowledge of education to help students improve their academic achievement and higher order thinking skills, as well as accommodate the changing demands of technology.

In the survey, respondents were asked to name the entity/entities that provided their certification, selecting from a comprehensive list. It is important to note that considerable overlap can apply to this variety of certificates. An individual instructor could have multiple professional and industry certificates and also state/province licenses, which compounds the complexity of this issue. The highest percentage of instructors held state contractor licenses (44 percent), state teacher licenses (36 percent), and/or certification from NATE (41 percent). The remaining respondents indicated that they hold certificates from the following: 22 percent from the Institute for Credentialing Excellence (ICE) and 17 percent from the Refrigeration Service Engineers Society (RSES). Interestingly, 11 percent said certification was not applicable for their situations. Clearly, further examination of overlap and certification requirements is warranted.

Student Certification. Respondents were also asked to indicate what certificates students received during the normal coursework or upon graduation from their programs. Almost 27 percent indicated that this was not applicable to their students, and the next highest percentage were represented by ICE (18 percent), NATE (10 percent), and NOCTI (5 percent). Half of the respondents left comments reporting on other certifications their students received and the majority stated that students were obtaining EPA 608 refrigerant handling and OSHA construction safety certifications. The seemingly random pattern of responses also points to no discernable pattern regarding student certifications.

For more on this topic when it comes to actual hiring practice, see the companion report authored by Burning Glass Technologies.

An area that warrants additional research is apprenticeship programs. The Canadian report accompanying this analysis lays out their formal process and discusses suggested policy changes. In the U.S. the recently reauthorized Workforce Innovation and Opportunity Act of 2014 provided for additional funds to enhance and encourage apprenticeship programs. These training-while-you-work programs are a proven route for training, certifying and recognizing HVACR employees.

4. PROFESSIONAL DEVELOPMENT FOR HVACR INSTRUCTORS

A key section of the survey focused on professional development or PD. Instructors were asked about the location, content, and quality of the PD they have experienced, in addition to problematic areas that affect the quality and quantity they have received.

Respondents reported that the geographic location of training (on campus, within the state, and/or at the national level) is evenly split with no location outweighing the others; instructors seem to take courses in all locations in equal parts. However, nearly 44 percent received some form of online training, an area that needs further scrutiny to determine content, quality and relevance—as well as how online programs vary from “brick and mortar” programs. Others noted they attend relevant webinars, read trade publications and by talking with their peers.

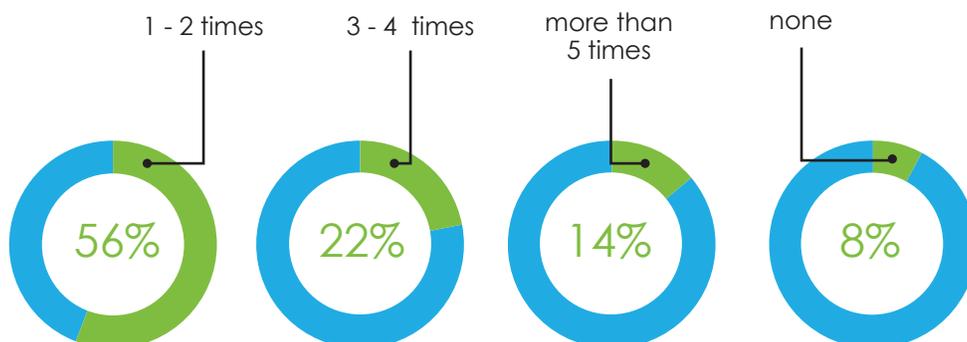
Fifty-six percent of respondents participated in PD activities once or twice per year, 22 percent attending trainings three to four times per year, and 14 percent claim more than five times a year. Almost 8 percent,

44% RECEIVED 
SOME FORM OF **ONLINE TRAINING**

however, responded that they had not attended any type of training events in the past year. This response made it obvious that a number of instructors—for whatever reason—are not receiving the training that could advance their pedagogy or technical skills. In Canada, a significantly higher percentage (33 percent) attended five or more professional training events per year; however, nearly 10 percent of respondents stated they never attend PD events.

Nearly 50 percent of respondents pointed to HVAC Excellence’s annual conference as the most frequent provider of the training they receive. The next most frequent provider is the HVACR & Mechanical Conference for Education Professionals at 28 percent. Other groups offering PD attended by instructors included: RSES (24 percent); AHR EXPO (22 percent); the Association for Career and Technical Education (both state and national events) (15 percent); ASHRAE (14 percent); ACCA (9 percent); PHCC (6 percent); and HRAI (3 percent). The majority (55 percent) of Canadian respondents participated in training provided by HRAI.

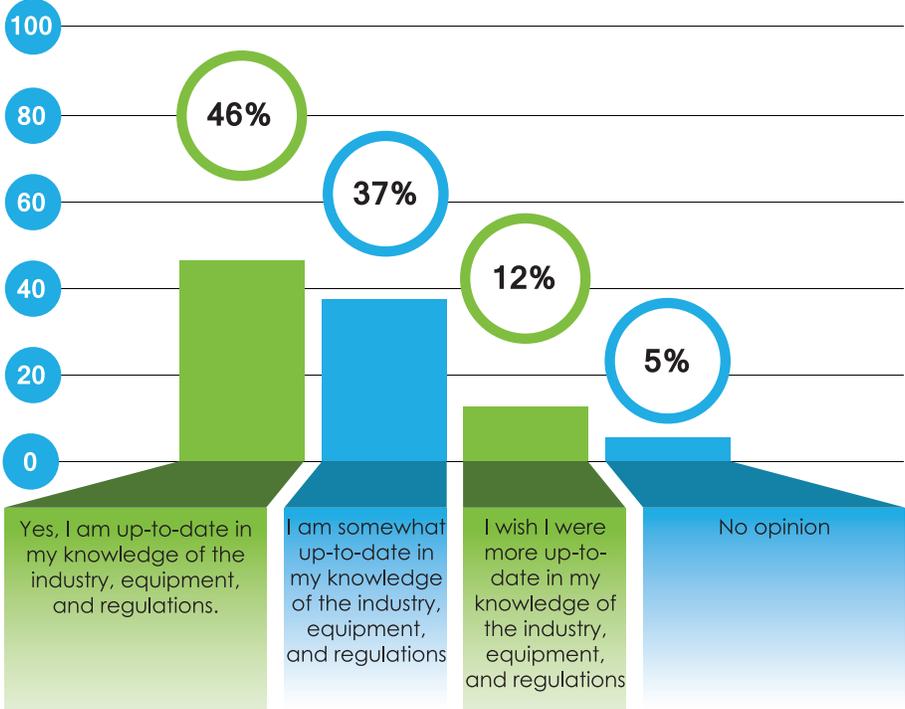
ANNUAL PARTICIPATION IN PROFESSIONAL DEVELOPMENT



Respondents were asked to react to the statement, "Overall, the HVACR professional development I receive is relevant and helpful to my ongoing teaching." This question sought a self-assessment of how individual instructors regard their knowledge of the industry. A surprising 37 percent of all responded that they felt "somewhat" up-to-date in their knowledge of industry requirements, with less than half rating themselves as sufficiently up-to-date; however, 55 percent of Canadian respondents felt

they were sufficiently up-to-date. In both the U.S. and Canada, similar percentages stated that they "wish" they were more up-to-date in the same areas (12 percent in the U.S.; 11 percent in Canada). These responses are strongly indicative of a need for current, in-depth, relevant professional development that is tightly linked to industry and workforce requirements. Once technical knowledge falters at the instructor level, student preparation and competence can be called into question.

OVERALL, THE HVACR PROFESSIONAL DEVELOPMENT I RECEIVE IS RELEVANT AND HELPFUL TO MY ONGOING TEACHING.



Respondents were asked for reasons why they may not be receiving sufficient PD. Thirty-five percent responded that there was no institutional budget to support travel or registration fees, but thirty-five percent also responded that they received sufficient PD. Many survey takers commented on the time of year when training was offered, stating that attending during the school year is problematic. A fifth of respondents said there was a lack of institutional, or insufficient high-quality providers. As was predicted, it is evident that financial constraints and timeliness influence the frequency and nature of ongoing professional development.

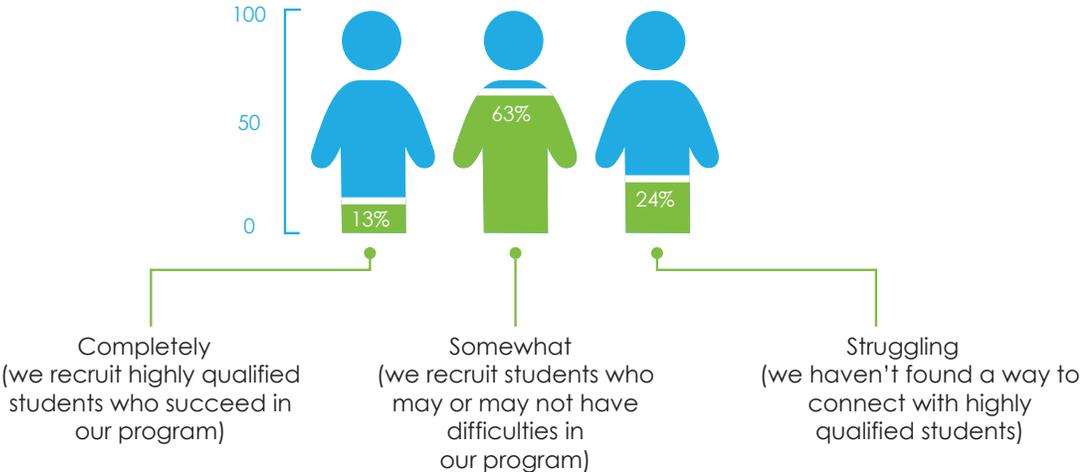
Instructors indicated they needed additional training to enact better internships and apprenticeships with employers. Over 66 percent of instructors believe improvement is necessary so they can learn to build strategies to increase internship and apprenticeship programs.

Professional development providers also need to include content that will help instructors build better relationships with employers. Approximately 64 percent indicate this is a critical area for improvement. Without sturdy relationships with employers, programs will operate in a void, divorced from job placements and crucial input from employers.

Apparently, professional development also lacks strategies for recruitment and retention. Only about 27 percent considered training in that area to be satisfactory, while 64 percent believe improvement is necessary or what is provided is only somewhat satisfactory. Without strong strategies for recruitment of students to these programs it only exacerbates the lack of future employees.

Respondents indicated that HVACR programs work fairly closely with advisory boards and other community resources—although there is room for improvement. Nearly 58 percent collaborate with a local/regional workforce advisory committee, which meet on a regular basis. Forty-two percent provided less specific information, indicating they had “many” business and industry partners. Other collaboration fell into very small percentages, attesting to the need for additional industry partners. The implications indicate an opportunity for HVACR employers to reach out to training programs, offering their expertise to shape and improve the training that students receive.

EFFECTIVENESS OF RECRUITMENT STRATEGIES



5. MARKETING AND RECRUITMENT STRATEGIES OF HVACR PROGRAMS

The final section of the survey focused on marketing and recruitment strategies to attract students into HVACR training programs. The responses were

“STRUGGLING TO
FIND A WAY
TO ATTRACT HIGHLY
QUALIFIED STUDENTS

revealing. Over 63 percent indicated that recruitment strategies were only somewhat effective, and that includes recruiting students who may have academic difficulties. The smallest percentage (13 percent) responded that they succeeded in attracting highly qualified students, while almost 24 percent reported that they were struggling to find a way to attract highly qualified students. This is a finding with huge implications for educators, administrators, and employers alike.

One inferential finding is insufficient or ineffective recruitment practices on the part of post-secondary programs. We also suggest that secondary institutions are similarly challenged by student disinterest, apathy, and lack of awareness of career options and programs within the HVACR field. This has direct implications for high school administrators, guidance counselors, parents, and HVACR employers. The fact that most HVACR programs are under-enrolled suggests that there is an information gap, as well as a relational gap, between HVACR employers and the students who represent their potential workforce. We can conclude that there is a pivotal opportunity for employers to engage directly with secondary and post-secondary staff and students as well as returning veterans and members of the National Guard, as well as additional efforts for women and minorities.

It is apparent that educators and administrators need help developing strategies that will attract qualified students into HVACR programs. Whether these strategies are informational, motivational, or a combination, it suggests an active role for HVACR employers. These employers could advise and support educators in their recruitment efforts, and participate with them as colleagues in a joint endeavor to fill training programs and provide an adequate supply to the workforce. Respondents reported a heavy reliance on “passive” marketing, such as brochures, flyers, email blasts, radio announcements, social media, and website announcements rather than sustained interaction with potential students. Only seven percent of schools translated their marketing and recruitment materials and announcements into another language.

STUDENT WORD-OF-MOUTH
A MARKETING
RECRUITMENT STRATEGY”

It is remarkable that 78 percent of respondents considered student word-of-mouth a marketing and recruitment strategy. While a personal recommendation may carry weight, it nonetheless is an indictment of program recruitment efforts if that is considered the most frequent and effective way to recruit students. Program representatives do report working with high school guidance counselors in a variety of ways, including meeting with them personally and also with students and parents at local high school Career Days. A third of post-secondary instructors rely on high school and secondary schools to “feed students” into their HVACR programs.

■ RECOMMENDATIONS FOR PRACTICE AND POLICY ■

This study was framed by three overarching questions, each addressing the issue of adequate supply of highly trained workers entering HVACR industries. The study focused on 1) preparation for HVACR employment, 2) policies that influence education and training, and 3) improvement of existing practices. The responses to this survey clarified these issues—and brought forth additional topics for consideration. To combat the crisis of supply and demand, the HVACR Workforce Foundation puts forth the initial steps of a North American Plan.

1. INSTRUCTOR PREPARATION AND ONGOING PROFESSIONAL DEVELOPMENT

Ensuring that North America has a sufficient supply of highly trained workers is a responsibility that the educators who responded to this survey appear to feel quite keenly. We learned through their responses of the myriad challenges that confront HVACR training programs and instructors. The first was the preparation and ongoing professional development of the instructors themselves.

While the majority of instructors who responded to the survey had a terminal degree at the associate's level, it should be noted that a higher-level degree may not be necessary to provide solid instruction in the HVACR field. But whatever the level of education, technical skills and pedagogical practices grow stagnant without ongoing professional development (PD). Of course, the quality of PD varies; receiving lower-quality PD is of little benefit.

The lack of opportunity to engage in high-quality training—whether because of institutional constraints or issues related to the quality—has potentially severe

effects on the quality of HVACR training. Further compounding the issue is the relatively brief number of years before many HVACR instructors retire, making it even more critical that they stay current with new curriculum and pedagogy techniques as well the changes that will occur in HVACR industries. Another driver of professional development is the advent of the “Internet of Things” as it relates to HVACR equipment. Instructors must be current in order to train future technicians. The Internet of Things is no longer a hypothetical but a reality and must be addressed within the profession.

The candor of respondents who indicated that they did not feel up-to-date with the HVACR field is a further indicator of the need for sustained, in-depth, and high-quality PD. A first step in ensuring the quality is assessing the quality of the provider. Further steps include alignment of the content with a program's curriculum and instruction as well as with certification requirements and any state-mandated licenses.

But professional development is actionable. There are ways in which its quality can be heightened; pathways to additional resources from external sources can be developed to enable and support it. There is no question PD is an imperative necessary to ensure that instructors remain current with the changing demands of the HVACR workplace. Parenthetically, an additional benefit of training received in groups is the opportunity for educators to network and share best practices, particularly important for instructors who work alone or have very few colleagues.

Based on the survey findings, the following actionable recommendations comprise the core of the North American Plan. Of course, additional input is needed from the entire industry and organizations such as HVACR trade associations and their state chapters, as well CTE associations at the secondary and post-secondary levels.

“**TECHNICAL SKILLS
AND PEDAGOGICAL PRACTICES
GROW STAGNANT**”

Recommendations for Professional Development

1 Enact a plan that screens professional development providers, maintaining a database of those suitable to provide HVACR training at both the secondary and post-secondary levels. While not mandatory that programs use them, a centrally located database of qualified providers helps to ensure that the needs of instructors will be met. A user could search at the local, regional or state/provincial level. Quality can be assessed through provider applications to states and provinces or have a current certification by an industry recognized credentialing entity. Programs and institutions can easily access this database to inform their choice of providers, as well as provide evaluative feedback to states and provinces to keep the quality of providers high.

2 Establish funds through local and regional HVACR employers earmarked for PD for HVACR training programs. Programs could apply for funds to enable a sustained, relevant plan for professional development for instructors. This would also nudge HVACR employers into an active role with educators.

3 Increase the presence of HVACR industry employers in the provision of PD. This could occur on-site; industry providers could assess program needs and match their delivery of content to the most urgent areas. This would help to ensure that program instructors align curriculum and instruction to workplace needs.

4 Work with local workforce advisory committees and workforce industry boards to inform program content and workplace demands to ensure that PD not only focus on education, but on connection to the workplace.

“KEEP THE QUALITY”
OF PROVIDERS HIGH

Professional development is actionable. There are ways in which its quality can be heightened; pathways to additional resources from external sources can be developed to enable and support it. There is no question professional development is an imperative necessary to ensure that instructors remain current with the changing demands of the HVACR workplace.

2. ACCREDITATION, CERTIFICATION, AND LICENSURE: POLICIES INFLUENCING HVACR TRAINING

Policies affecting HVACR training and entry to the workforce include those that come from accrediting entities as well as licensing and certification agencies. Certifications are numerous and may overlap; students often must receive multiple ones to be job-qualified. State licenses are usually necessary as well. Job applicants must be prepared with the appropriate certifications and/or licenses to begin work, or at least after a grace period. The already complex requirements of certificates and licenses may differ in one state versus another. This compounding factor can reduce the likelihood of mobility of HVACR workers, and makes HVACR jobs even harder to fill.

The primary recommendation is the creation of a universal set of standards to be used in a uniform HVACR license. A reliable and actionable curriculum and policies could provide a model for a similar set of standards. An example of this is the National Institute for Automotive Service Excellence. Since 1972 this organization has worked to improve the quality of vehicle repair and service by testing and certifying automotive professionals. Over 300,000 mechanics have received the Automotive Service Excellence Blue Seal certification, selecting from 40 possible tests based on cars, trucks, equipment and repairs. Their website (www.ase.com) makes it easy for technicians, employees, students, and teachers to find what they need. Technicians can find test materials, a list of accredited schools, and information on certification, and instructors can find online and face-to-face professional development opportunities.

The recommendations for policies in this area are based on the premise that certification, licensure and apprenticeship programs can be streamlined into a more coherent whole. There is sufficient evidence that the bramble patch of requirements is difficult to understand and negotiate, possibly slowing entry into the workforce. An aggressive agenda, included in the North American Plan, can dramatically improve certification and licensure.

Recommendations for Licensure and Certification

1 Form a consortium of leaders from HVACR professional associations, industries, and institutions providing HVACR training to develop a plan for interstate standards intended to leverage various polices. This consortium must have an ambitious and far-reaching agenda, reviewing industry standards, program curricula, state license requirements, and certification and apprenticeship requirements to provide recommendations to streamline existing certifications and licenses.

2 Conduct substantive research on alternative routes to the HVACR workforce, investigating the experience and prior education of students choosing alternatives to traditional pathways to HVACR training, such as apprenticeships. This is an area for the U.S. to study Canada's system. What characteristics do they have in common? Do alternative training programs offer ideas that could be used in traditional training programs? To what extent do alternative pathways to HVACR training produce a highly trained and employable supply of prospective workers?

3. EXISTING PROGRAM IMPROVEMENT

Solid preparation and excellent professional development are levers that affect the quality of programs. But students enrolled in HVACR programs present challenges to instruction as well, thus affecting program quality if not addressed. As reported earlier in this study, instructors noted that many students lack

basic skills in reading, math, science and soft skills; are insufficiently motivated; do not understand that effort alone will not ensure success in the HVACR workplace, and lack knowledge of the HVACR industry and the nature of actual work.

By way of review, the highest percentage of enrolled students was second-career adults returning to gain new skills and employment opportunities. Another growth area for new employees is veterans leaving the military and members of the National Guard. With projections of over a million members of the armed forces leaving in the next 5 years this is another source for HVACR schools and employees to seek future technicians and mechanics

A DEGREE OF FLEXIBILITY AND OPENNESS TO NEW CHALLENGES



The high number of second-career adults enrolled in HVACR program has its own set of implications that warrant further investigation and research. What experience do they have—and in what fields? Is there a pattern to their educational and experiential backgrounds, or do they seem random? We can hypothesize that these adults have maturity and years of work experience in another field. Entering another field as experienced adults point to a degree of flexibility and openness to new challenges. These adult students, with increased supports, could become a significant source of talent for the HVACR workplace. It is possible that different recruiting efforts could bring in a greater supply of these students.

To that end, the following recommendations emphasize both further study to gather evidence and data, and argue for substantive collaboration between HVACR educators and HVACR employers.

Recommendations include the following:

1 Conduct attitudinal surveys and convene focus groups of current and potential students (traditional, veterans and second career adults, women, and minorities) to determine their core beliefs and attitudes about their training at both pre-test (program entry) and post-test (when leaving the program). Findings could provide helpful information that programs could use to modify curriculum and instruction.

2 Consider the formation of mentoring programs, job shadowing or ride-alongs, beginning at the secondary level. Less formal than internships and apprenticeships, these practices increase supports for struggling students, bonding them to knowledgeable adults, and lessening the likelihood of dropout. Peer tutoring programs should be considered as supportive practices wherein a more advanced cohort spends time with a beginning cohort. Particular attention should be paid to underrepresented groups, such as women.

3 Through extensive outreach from HVACR education and training programs to HVACR employers—and the reverse—discover how to create opportunities for internships and apprenticeships with HVACR employers. Mutually supportive recruitment must occur for the supply to meet the demand.

4 Ensure that standards and benchmarks for student progress are carefully designed to align with curriculum and certification requirements as well as workplace requirements. HVACR employers can play a key role in shaping benchmarks that monitor student readiness for the workforce. Through these and other strategies, relationships between training programs and prospective employers could be built and sustained. These strategies all have the potential to improve

collaboration between educators and employers, and/or strengthen existing efforts to ensure a steady pipeline of qualified workers through targeted recruitment, strong retention plans, and ongoing program evaluation.

CONCLUSION

The data from the survey respondents was at times surprising but always informative. The heartening news is that there is a core force of thoughtful educators dedicated to providing high-caliber training for current and future HVACR employment. But they cannot do it alone. Many struggle as the only instructor in a program, cut off from collegial exchange, new ideas, and feedback. Respondents expressed frustration over the lack of solid relationships with HVACR employers, looking to them for substantive contributions to improve the quality of HVACR training, based on industry needs and standards.

Many respondents willingly took on an extended role beyond instruction alone. But an extended role that includes teaching, building and sustaining relationships with employers, developing marketing and recruiting strategies to bring students into their program, and keeping up-to-date with industry requirements—all of these can lead to burnout and attrition in the educational workforce.

Upon the conclusion of this study, the researchers underscore the need for further research on a multitude of aspects that affect the quality of HVACR training, thus affecting the supply of workers that HVACR employers need. Now it is time to take these findings and recommendations and move to the enactment of a far-reaching, pragmatic, and multi-faceted North American Plan that will last for many years, serving both the educational and industrial sectors—and serving them with distinction and integrity of evidence.

THE FOLLOWING TRADE ASSOCIATIONS ARE SUPPORTING MEMBERS OF THE HVACR WORKFORCE DEVELOPMENT FOUNDATION:

ACCA: The Indoor Environment & Energy Efficiency Association
Air-Conditioning, Heating, and Refrigeration Institute (AHRI)
American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
Heating, Air Conditioning and Refrigeration Distributors International (HARDI)
Heating, Refrigeration and Air Conditioning Institute of Canada (HRAI)
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