

# A Comparison of Construction Industry Craft Training and Education in Australia and the United States

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The manner in which building trade skills are passed from one workforce to the next is one that is continuously changing. Not only do these methods develop over time, but also yield differing approaches to training given their geographical isolation from one another. As different means of educating the workforce for the built environment arise, it is essential that a focus is put on informing other educators of effective procedures in the training of trade workers. The objective of this study is to provide a comparative analysis of the practices and methods by which construction trades workers are trained and qualified in two different countries, Australia and the United States of America. A review of literature published in the subjects of vocational education and construction trade training in each country is presented. The results of a qualitative research including an investigation into vocational education curriculum and interviews with training instructors are also presented.

**Key Words:** Construction Trades, Training, Vocational Education, United States, Australia

## Introduction

The construction industry is completely dependent on its foundation of skilled trade labor, which has been in a worsening shortage since the 1990's. A study in 2001 was conducted by the Construction Users Roundtable (CURT) in which 82% of respondents reported a labor shortage on their projects. In addition to this, 78% of these respondents also indicated that the shortage had worsened in the three years prior (Goodrum et al. 2007). Many of these shortages can be attributed to the fact that the construction trade workforce has begun to age and been cast in a negative light due to a poor image of job safety and working conditions. Another leading contributor to this labor shortage is the lack of training opportunities available to the individuals that do express an interest in entering the industry. The ability to attract and retain workers is greatly hindered by the fact that in the United States it is often not easy to find training and certifying bodies to allow one to become a qualified craft worker (Goodrum et al. 2007). The motivation behind this study is to understand why training has been such an overlooked facet of the construction industry for so long. The aim of the research is to compare the practices by which skilled construction labor is trained and qualified in Australia and the United States of America. By comparing the craft training programs of Australia and the United States, this paper attempts to clarify the reasoning behind the lack of emphasis put on the successful training and certification of craft workers in both of the concerned countries.

In the construction industry's ongoing pursuit to provide clients with a superior product, the ability of the construction laborer to perform at a consistently high level of quality is one of great importance (Smith & Hayton 2011). Construction labor is the source of much of the inconsistency in the built environment, due to human nature and the inherent variety of level of skill the trade workers can possess (Love et al. 2009). This paper presents a comparison of practices on the methods of training construction trade workers in different ways. The topics discussed within this paper are in need of more attention if the construction industry is going to continue to increase productivity. Much in the way an emphasis has been placed on safety education and training in the last 15 years, a similar emphasis could be placed on improving construction trade skill. With an increase in skill of trade workers, decreases in rework and defective performance can be expected, leading to greater owner satisfaction as well as increased profits for construction service providers. If contractors can improve the training opportunities of all of their craft labor, there is well documented evidence in numerous studies by the CII that rework costs are reduced significantly (Love et al. 2009).

## *Vocational Education and Training*

The process of Vocational Education and Training (VET) is one that has taken a multitude of different forms over its many years of development and progression. From the most informal learning environments in the tool shed of a grandparent to world class, *state-of-the-art* facilities in nationally accredited universities, the means to teach a potential worker a construction trade are as varied as the trade skills themselves. The goal of providing a consistent quality of craftsmanship for construction projects is one that has been relentlessly pursued by the industry. This is precisely the role of VET, to educate and train the skilled workforce through a number of training practices.

Building trades training is one that, particularly in a society concerned with the use of in-direct labor supervisors as quality control, is often overlooked by educators and industry professionals alike, as evidenced by the decline in secondary school VET programs in America. This lack of emphasis on providing the construction workforce with a consistent resource of adequately trained building tradesmen could prove to be particularly detrimental to a country such as Australia, which has already been affected by labor shortages (McGrath-Champ et al. 2011). Australia's geographic isolation precludes the possibility of relying on immigrant labor, as is often times the case in the United States (Wang et al. 2010). This highlights the importance of the ability of any country, isolated or not, to satisfactorily train a construction trades workforce capable of meeting the countries building demands.

This is exactly the role that VET plays in educating and training the skilled craft labor of the construction industry in each of these countries. Through a variety of different programs and approaches, VET for skilled labor is administered from a number of different registered trade organizations (RTOs) in both Australia and the United States. This educational opportunity is an enormously important first step on the path for many potential workers to become successful craft employees. The shortage of labor has, in large part, been caused by the increasing number of students attending four-year institutions instead of following the blue-collar traditions of generations past in both countries. The lack of adequate training for the craft industry has contributed greatly to the misrepresentation of construction labor as being an undesirable, unsafe profession with low pay and poor benefits. With the advent of an updated training curriculum, many organizations, such as the Training and Further Education (TAFE) schools of Australia and the National Center for Construction Education and Research in America, look to reverse this image.

The study primarily focuses on the training of carpentry and plumbing trades. These two trades were chosen for much of the research due to the large number of workers in these industries that are trained relative to other construction crafts or unskilled labor. Informal training, while acknowledged throughout the study as a source of much of the education in the modern construction industry, is not easily researched into due to a lack of recorded informal training practices.

### **Methodology**

A literature review of in the areas of vocational education and training in the construction labor trades in both Australia and the United States was conducted. In addition, a qualitative research in the form of semi structured interviews with VET instructors was carried out in Australia. This approach was taken in order to obtain a more complete understanding of the training methodologies adopted by the two countries as well understand their philosophical stand point. A curriculum analysis of the construction VET programs that were selected for this research process was conducted. This analysis includes a comparison of courses, competencies, as well as evaluative measures taken by both programs. The curriculum review also shows a comparison of the competencies required for several different qualification levels of craftsmanship in each of the countries. This comparison allows the training practices to be more easily dissected and understood in relation to one another.

### **Trades Training In Australia**

Australia is a country with a very unique labor situation. Due mostly to its geographic isolation, the country cannot rely on immigrant labor in the way that the United States can. Because of this, Australian labor comes at a much higher price than many other countries. Often there are shortages of labor, delaying projects and driving up job costs (McGrath-Champ et al. 2011). This also has placed a degree of urgency upon the labor industry training organizations to ensure that there will be enough skilled labor to work in the construction field in the future as well.

The predominant method of training that Australia has adopted is Competency Based Training (CBT) programs. These programs are implemented in “Training Packages” that have risen in popularity since the 1990’s (Barrow 2005). Most often these Training Packages are administered at an Australian Qualifications Framework (AQF) accredited institution, such as the TAFE School at Royal Melbourne Institute of Technology in Melbourne, Australia.

### *Competency Based Training Curriculum*

Competency Based Training programs are very common in nearly every facet of vocational education. It is particularly well suited for use in the construction industry, due to its requirement for students to demonstrate the ability to complete an exact “competency” that they may encounter often during their trade work in the field. Competencies are the specific individual tasks that must be performed successfully by the student in order to proceed with the training program. After successfully demonstrating an understanding of the principle, or performing a directed task, the instructor moves on to the next competency with the student.

By using CBT in these controlled environments, instructors are able to train these potential trade workers in a much safer and learning conducive environment. This is the largest benefit to on-the-job training that has been a staple of construction education in the past. In the controlled environment of a classroom laboratory, the instructor is able to clearly and easily tell if a student is not performing a competency to the desired standard. Competency based training has been widely used in Australia since the 1980’s and was adapted into the more easy-to-use format of Training Packages throughout the 1990’s. Training packages, although still being implemented, allow the competencies in the CBT to be compacted and grouped together into different packets. This way the packages can be labeled for certain subjects, plumbing or carpentry for example. Beyond this, the more advanced competencies can be split into higher levels than the more fundamental ones, allowing for differing levels of qualification within the craft. The common form of qualification in the Australian craft market is “Certificate II” and “Certificate III” as a general craft worker. Certificate II level employees would be comparable to an introductory worker in America, commonly referred to as an apprentice. A Certificate III worker is a fully trained employee that is capable of performing nearly any task required in the field, referred to in America as a Journeyman. There is also a Certificate IV level of qualification, similar to a Master Craftsman in America, but this title is level of training is commonly reserved only for trainers of other trades workers.

Training packages in plumbing and carpentry crafts compiled by the Australian Qualifications Framework (AQF) have been reviewed extensively as a portion of the research for this paper, and have been compared to the requirements of attaining the analogous level of qualification in the United States. These training packages are created by industry professionals at the AQF and then taught, administered, and assessed at VET schools throughout Australia. CBT has completely transformed the processes by which construction labor has been trained in Australia in the past. Standardized competencies have made it much easier for the training instructors to keep a consistent level of quality while still being able to reach as many potential workers as are interested. Additionally, with the development of training packages as a means of administering these competency programs, the process has been streamlined even further. As the Australian government has become involved in regulating these training packages through the AQF, there has been a much higher degree of safety training mandated in the programs, continuing to improve the image of the craft industry to people entering the workforce. As the work place conditions continue to improve, it can be expected that the desirability of construction trade careers will only increase, all the while resolving the labor shortage issue.

### **Trades Training In America**

Traditionally, the training that has been available for construction trade workers in the United States has been available mostly through employers. In fact, as recently as 2007 it has been stated that 66% of craftspeople were trained by an employer while only 15.2% received any kind of formal, standardized training for their trade in a school or at a trade organization (Goodrum et al. 2007). While this method of providing training in an actual construction site setting certainly has advantages, it lacks the ability of the trainers to standardize their approach.

### *American Competency Based Training Curriculum*

Not until the 1970's with the production of an early set of Competency Based Training curricula for carpenters developed by the United Brotherhood of Carpenters entitled Performance Evaluated Training Systems (PETS) did the training for the craft industry start to become standardized. PETS was the first training program to become overtly organized and modular, allowing trainers around the country to instruct individual sections of the curricula to any employee that needed it. Many of the problems previously encountered with all craft training began to be solved with the implementation of the PETS program. One of the most common problems was coordinating what apprentices were taught in class with tasks that they actually performed on daily work days on construction projects. The individualized modules that the program offered allowed apprentices to pick and choose which sections were applicable to their job at the time. As the construction industry progressed through the 1970's and 1980's, the PETS program material was not updated and soon became stagnant. At this time, the National Center for Construction Education and Research developed its own set of modernized CBT for nearly every trade in construction (Wang et al. 2008). NCCER craft curricula are now updated regularly by industry professionals. These volunteers can be construction professionals or craft instructors from around the nation, ensuring that training materials are able to remain at industry standards (NCCER 2012).

Competency Based Training (CBT) is now the standard for performance evaluation and skill education of construction industry trade education in America. In the NCCER program, CBT is divided in to two distinct sections, Objectives/Competencies and Performance Tasks. The Objectives/Competencies section of the program is a more traditional lecture format style of education. This involves a description by the instructor of a set of objectives followed by either a written or oral evaluation of the objective by the student. Objectives and Competencies may also contain a performance demonstration by the student; however this is often left in the performance task section.

Performance Tasks rely heavily on the use of specific individual tasks that are first explained and demonstrated by the CBT instructor and followed by a performance test for the student. The student must be able to satisfactorily repeat the objective in order to advance to a higher level of objectives. There are a variety of curricula that are written by different institutions and registered trade organizations that administer CBT.

### *Open Shop vs. Union Training*

The type of training received by craft workers in the United States varies greatly depending on whether the particular trainee is located in a heavily influenced by labor unions or not. Labor unions have a tendency to provide and require much more training for their workers, compared to their open shop counterparts (Wang et al. 2008). Not surprisingly, the unionized trainees have substantially higher levels of completion rates as compared to open shop workers. This may be attributed to the fact that unionized trainees are typically still compensated for their training exercises whereas open shop employees simply attempt to sneak training practices in wherever possible during the course of a typical work day (Wang et al. 2008).

Union Training also tends to remove much of the undocumented on-site training hours that are accounted for in much of the open shop training programs. Due to the closer monitoring of the training programs sponsored by these unions and the reputation that hangs on them, the success of these trainees is of the utmost importance to the particular union (Wang et al. 2008). Although a much larger portion of training provided by labor unions is more accurately documented, this does not take away from the employee provided training that comes from open shop contractors. Much of this training is similar, if not identical in nature. However, the fact that any evidence of training completion is unavailable makes it much more difficult to determine the skill level of these employees. This observation could perhaps provide a source of error in the graphic displaying the significantly lower training completion rate in the open shop training sector. If it is not documented that training was ever initiated, much less completed, these reports could be skewed. However, despite the possibility that more training could have occurred, there is no documented proof, so nothing can be assumed beyond what the contractor has recorded (Wang et al. 2008).

Though the development of a regulated and standardized form of craft training has taken several decades to manifest itself, the continued improvement and critique of the current CBT based system will continue to yield beneficial results. As the training programs become more widespread, and even necessary, in a similar manner to Australia, the United

States can also expect to see its labor shortage begin to disappear (McGrath-Champ et al. 2011). The modularization of these programs has allowed individuals to select which specific trades are more applicable to their current needs. This allows for faster, more efficient training with a decrease in wasted time training workers in skills that may not be applicable to their careers.

## Curriculum Model Analysis Comparison

The easiest way to distinguish differences between two construction trade training programs is by a direct comparison of the training curricula. Two curricula that have been investigated here are the Level 3 plumbing certification from NCCER and the Certificate III in plumbing from the TAFE School of RMIT University in Melbourne, Australia. The major difference between the two selected programs is that the NCCER training is provided in a classroom whereas the TAFE program is an apprenticeship, which could include classroom education as well as on-site training. Another is that the NCCER program divides its Level 3 plumbing certification into three distinct parts, whereas the RMIT curriculum combines the first two “stages.”

### *NCCER*

In NCCER there are 13 “modules” in Level 1 (NCCER 2011). These modules cover topics that range from plumbing safety to fittings and different piping materials. Each module requires specific competencies to be completed before advancing to the next one. By requiring each of the trainees to successfully complete each competency to a predetermined level of satisfaction, a precedent of quality can be set for future work (Anthea 2004). The Level 2 of the NCCER curriculum advances the trainee on to more advanced competencies in subjects such as installing and testing water supply piping, as well as plumbing fixtures, valves, and faucets. A more in-depth understanding of plumbing calculations is also taught and applied in this group of competencies as well. There are 12 modules in the Level 2 curriculum, making it approximately the same length as Level 1.

Level 3 of the NCCER curriculum begins to introduce the trainee to design roles of plumbing systems such as sizing supply and venting pipes, as well as advanced applied plumbing mathematics. Additionally, the trainee practices in specialty plumbing trades such as compressed air piping. A trainee that has completed this level of trade training is fully capable of accomplishing nearly any required task in the field. The trainee is not, however, capable of providing formal training to other trainees. NCCER also provides a Level 4 certification that allows trainees to begin to make a transition in to a managerial role. There are competencies in construction business practices, as well as an extensive safety education module. Another module focusing on project controls allows the trainee to become educated in how to manage projects, cost, and other personnel.

The TAFE School of RMIT University in Melbourne, Australia is well known for its consistent success in implementing competency based training into training packages for construction trades, particularly in plumbing (Barrow 2005). These training packages are administered through apprenticeships that offer trainees the ability to learn in a classroom environment, as well as be evaluated on their performance competencies on a job site (RMIT 2010). This method of teaching allows students to obtain a more well-rounded education by studying topics such as safety and business in a classroom while still being able to demonstrate skills on the jobsite (Barrow 2005). The Certificate III curriculum is separated similarly to the Level 3 NCCER plumbing program. There are three different stages that each trainee must complete.

The first two stages are completed together with a total of 35 courses between them, which is slightly more than the first two levels of the NCCER program. However, most of the topics that are covered in these stages are very similar. Topics covered include fusion pipe welding, gas principles, as well as installation of sanitary systems. These first two stages serve as an introduction in to the plumbing trades for the trainees, whereas the third stage requires more in depth understanding of the craft. Stage three of the TAFE School Certificate III plumbing program is a much more hands on and intensive group of courses, relative to the first two. This stage is where much of the on-site competency demonstration occurs (RMIT 2010). The topics in this stage allow the trainee to go out and work in the field by teaching building codes and regulations, roof safety, as well as plumbing measurements and calculations to be performed in the field. RMIT, in similar fashion to NCCER, also offers optional a fourth level of certification, the Certificate IV in Plumbing Services. This certification requires completion of 14 additional courses in the curriculum.

These courses include sections on commissioning systems, testing, and other managerial tasks. This certificate allows trainees to apply their knowledge of plumbing standards and regulations to become system inspectors.

The aim of this research is to compare the manner that skilled construction labor is trained and qualified in Australia and the United States of America. In support of this objective, the researchers have compiled and analyzed numerous resources characterizing construction trade training in each of the concerned countries. A synopsis of this comparison is presented in table 1.

*Table 1: Comparison of Construction Trades Training Criteria in Australia and United States (Sources: NCVET 2011, NCCER 2008, Barrow 2005)*

<b>Criteria</b>	<b>Australia</b>	<b>United States</b>
Training Program Completion Rate (Union)	83%	81%
Training Program Completion Rate (Open Shop)	N-A	40%
Training in Formal Classroom Setting	< 10%	20%
Training on jobsite (documented)	> 70%	8%
Training on jobsite (undocumented)	0%	72%
Number of Competencies Required for Level 3 (III) Certification	37	115
Number of Competencies Required for Level 5 (V) Certification	118	40

This comparison shows that the United States puts a much greater emphasis on the training of lower level workers, where as Australia certifies these same type of workers fairly easily. As for the higher level employees, a much lower amount of training is left in America. The AQF puts a much greater emphasis on these Certificate V employees as trainers.

After comparing the number of competencies required by the NCCER for Levels 2 and 3 in each of the carpentry and plumbing curricula to those required by the AQF for Certificates II and III in carpentry and plumbing, it is evident that while the total number of units is very similar, it requires much more training to achieve this level in the United States. Much of the units of competency remaining after Certificate III level in the AQF are reserved for craftsmen that wish to continue and become trainers themselves (Barrow 2005). However, in the United States, one can expect a worker of Level 3 qualification to be able to perform as a trainer of other employees.

## **Conclusion**

Competency Based Training (CBT) is an effective form of construction trade training. Australia and the United States have shared successes in educating construction trade workforce by utilizing the CBT approach. CBT allows for training to be standardized, which prevents trainees from learning different techniques through training received from different instructors. Through the standardization of craft training competencies in the programs of both Australia and the United States, the CBT programs have effectively found an answer to the problem of workers performing tasks in individual ways based on their past training. This type of training can allow workers to be more interchangeable and still perform at the same level. Competency based training is used in the craft training industry, this issue will continue to diminish (McGrath-Champ et al. 2011).

Performances Based Assessments (PBAs) are necessary to ensure that trade workers are able to perform a specified quality of work. Simply showing a trainee pictures and illustrations of techniques of craft practices may not be sufficient to ensure an employee's ability to perform the task. While written tests and examinations are a good way to test safety knowledge and conceptual information, these means of assessment lack the ability to gauge whether the trainee is capable of functioning as a craft worker on a jobsite. There must be a portion of the training that the trainee is able to demonstrate his or her capability and understanding of concepts. PBAs can be used as a means to certify a worker's level of skill in a particular area of their trade. In this manner, the certifying agency can see that trainees are

able to perform a specified task to a designated standard of quality before allowing the worker to practice in the field. Not only are the assessments themselves important to ensure that the training has been effective, but the administrators of the PBA must also be considered. This is why only certain registered trade organizations are qualified to give assessments. This is simply an additional measure to keep the level of quality of the training programs standardized.

Research has found that Australian companies require more ‘On-The-Job Training’ as compared to the classroom based training programs in the United States. Though both countries utilize apprenticeships and performance assessments, the findings indicate that the Australian method of trade training requires more hands-on education than that of the United States. This method may allow trainees to learn not only trade principles in a real-world situation, but also allow them to observe the on-site application of safety standards and project management procedures. These are topics that are more difficult to understand or convey in a traditional classroom format education (Goodrum et al. 2007). According to studies performed in 2008, an average of only 21.8% of all training that occurs in the construction craft industry in America is in a formalized setting. Almost all other training is performed on jobsites but is often left undocumented. While this experience likely provides the trainees with an invaluable hands-on approach, it is impossible to document or standardize training done in this manner (Goodrum et al. 2007). Australia, however, requires at least as much training to be done in real work situations, but all of it is documented and standardized by the Australian Qualifications Framework (AQF 2011). The AQF has outlined specific competencies and goals that must be accomplished before training can be considered complete or a qualification assessment can be given. Additionally, the employers that provide training through these programs are required to set aside time, separate from normal work day activities, so that the training can be performed (AQF 2011). This ensures that training is not given in a situation that could be rushed with numerous competencies being left out due to the need to accomplish a work task quickly.

The Australian method of providing formalized training on job sites with industry employers helps to keep the quality of training consistent across all trades and in different regions (Goodrum et al. 2007). In the US the framework is in place for this on-the-job training to take place, however, a documentation procedure similar to the one that already exists for formalized classroom training needs to be included so that a standardized instructional format can be implemented. No perfect method of craft training has yet been devised, evidenced by the number of workers that still lack adequate skill sets. Australia, while fully capable of training their employees in a professional on-the-job manner, could learn from the United States’ approach of enforcing classroom style learning before jobsite exposure. This allows general safety guidelines to be laid out before any workers step on site, further preventing accidents. Australia also has improvements to be made in their lack of training requirements for Certificate III qualification. If the standards for this certification are raised, further declines in project rework costs can be expected. The United States is able to greatly expand their documentation of jobsite training practices. The training is taking place already, however, without proper supervision and recording, there is no way to enforce that it is performed effectively. The greatest weakness of the United States’ training programs is the open shop completion rates. If these completion rates can be improved, perhaps to the level that labor unions are experiencing, a great increase in worker productivity and quality may be seen.

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