Canadian Apprenticeship Forum
Forum canadien sur l'apprentissage

THE CANADIAN APPRENTICESHIP JOURNAL

JOURNAL CANADIEN DE L'APPRENTISSAGE

FLEXIBILITY AND INNOVATION IN APPRENTICESHIP TECHNICAL TRAINING

SOUPLESSE ET INNOVATION DANS LA FORMATION TECHNIQUE DES APPRENTIS

Canadian Apprenticeship Forum
Forum canadien sur l'apprentissage

Table of Contents

Introduction & Acknowledgements

In efforts to support the *Flexibility and Innovation in Apprenticeship Technical Training* (FIATT) initiative funded by the federal government, the Canadian Apprenticeship Forum opened up a dialogue with apprenticeship stakeholders about the challenges that apprentices and their employers face when it comes to technical training. While a sizable majority of apprentices across Canada take temporary leave from their workplaces to attend levels of technical training at colleges, polytechnics and union training centres, it became clear that many stakeholders are experimenting with other approaches. This was the inspiration for this issue of the Canadian Apprenticeship Journal.

Assessing whether alternate approaches to technical training are effective must start with an understanding the barriers they are intended to address – everything from the financial impact of block-release training on apprentices (foregone wages) and their employers (lost productivity) to inconvenient location and/or scheduling of classes. Emerging technologies and new expectations around learning-on-demand are influencing how training is delivered, yet many within the apprenticeship community question whether these approaches support apprentice progression and completion. This invites an interesting debate about the value of tried and tested methods against opportunities for innovation.

This issue of the Journal asks, "Why not both?" We are pleased to bring you six excellent articles that highlight very different approaches to addressing the issues and concerns around access to technical training. Yet, there are consistent themes and best practices here – the importance of partnerships, the focus on apprentice learning outcomes and a willingness to experiment. There are opportunities to test and adapt these ideas across trades and across sectors, evaluating impact and results along the way.

In preparing this issue, my sincere thanks to our committee of apprenticeship stakeholders who helped us review and edit these articles:

- Shaun Barr from Algonquin College
- Judy Harris at the BC Industry Training Authority
- Dawn Stanger from the Saskatchewan Apprenticeship and Trade Certification Commission

Along with this group of volunteers and the authors of the articles in this issue, I welcome your ideas, thoughts and feedback. Let's keep the conversation about flexibility and innovation going!

Sarah Watts-Rynard
Executive Director
Canadian Apprenticeship Forum

Alternate Delivery Apprenticeship Technical Training in Canada: Context, Trends and Observations

Emily Arrowsmith, Canadian Apprenticeship Forum

1.0 Introduction

This article provides an overview of technical training barriers for apprentices and employers and outlines how trainers and the jurisdictions have tried to address barriers through alternate delivery methods, such as flexible class times, mobile training units and upfront, online and simulator training.

Input from the jurisdictions, previous CAF-FCA research and input collected at roundtable discussions were the main sources of information for this article. Relevant examples from the *Flexibility and Innovation in Apprenticeship Technical Training* (FIATT) pilots are provided.

2.0 Relevance

There are a number of reasons why addressing barriers related to technical training matters to apprentices, including improved labour market outcomes, skills development, diversity and coping with technological change. From an employer perspective, addressing barriers related to technical training has the potential to increase the availability of apprentices to work, increasing productivity.

2.1 Completion

Barriers related to technical training prevent some apprentices from completing their levels and programs. According to studies undertaken by Statistics Canada, the apprenticeship completion rate has been at 50 per cent or less for well over a decade.[1]

There are a number of benefits for apprentices who complete their training. Those who earn certification are more likely to be employed full-time and earn more than those with no certification.[2]

[1] See Sandrine Prasil, *Registered Apprentices: The Class of 1992, a Decade Later*. (2005), Denis Morissette, *Registered apprentices: the cohort of 1993 a decade later, comparisons with the 1992 cohort*. (2008) and Louise Desjardins and Nicole Paquin, *Registered Apprentices: The Cohorts of 1994 and 1995, One Decade Later*. (2010). All studies were undertaken at Statistics Canada.

[2] Marinka Menard, Frank Menezes, Cindy K.Y. Chan and Merv Walker, *National Apprenticeship Survey: Canada Overview Report 2007*. (2007), 24-26. See also Kristyn Frank and Emily Jovic, *National Apprenticeship Survey: Canada Overview Report 2015*. (2017), 7.

Completion also matters to employers. Industry determines the competencies skilled workers must possess. These competencies inform training content in apprenticeship programs. When apprentices do not progress through all stages of the training program – whether in compulsory or voluntary trades – they are less likely to be exposed to the full scope of trade. Consequently, they may not meet employer expectations in terms of knowledge, skill and ability.

When apprentices do not complete their technical training, society not only loses its educational investment, but may face the additional tax burden posed by unemployment.[3] When people earn their credentials, they earn higher wages and make significant tax contributions that benefit society.[4]

2.2 Accessible Training

Greater accessibility to training in remote and rural areas or low-volume trades builds capacity within the local workforce, supporting employment and economic growth. Individuals in under-resourced communities benefit from training and opportunity. Employers have access to a stable, highly-skilled local workforce.

2.3 Future Workplace Training

Many employers offer online courses when upgrading tradespeople's skills. Exposure to online learning during technical training prepares apprentices for future workplace training. Apprentices require advanced digital and computer skills to succeed in some careers.[5]

3.0 Context

3.1 Traditional Technical Training and Apprenticeship

Apprentices spend 80 to 90 per cent of their time learning at the workplace and 10 to 20 per cent of their time at a technical training institution such as a college, union training centre or private trainer. In every jurisdiction except Quebec, employers agree to release the apprentice to attend technical training. This generally means apprentices spend six to 12 weeks at an institution or training centre per year of apprenticeship. This delivery method is known as "block-release." Apprenticeship administrators set the curriculum and standards in each jurisdiction.

3.2 Participation in Technical Training by Various Learning Methods

According to the 2015 National Apprenticeship Survey, the traditional pattern of block-release remains the dominant form of technical training for apprentices:

- Long block release (three to ten weeks): 59.1 per cent

[3] Mark Schneider and Lu Michelle Yin, *Completion matters: The High Cost of Low Community College Graduation Rates.* (2012), 1.
[4] Ibid.
[5] CAF-FCA, *The Impact of Technology on Apprenticeship*, (2013)., 2.

- Full-time: 21.1 per cent[6]
- Self-paced: 10.5 per cent
- Day release: 7.5 per cent
- Short block release (one to two weeks): 7.0 per cent[7]

Only 9.7 per cent of apprentices took the required course work online or by correspondence.[8]

Although updated results are not yet available, 2007 National Apprenticeship Survey data indicates, apprentices attended these technical training institutions:

- Community college / CÉGEPs: 56 per cent
- Trade/vocational/apprenticeship centre: 29 per cent
- Union or company school: 5 per cent
- High school: 5 per cent
- Private institution: 4 per cent[9]

4.0 Barriers Related to Technical Training for Apprentices and Employers

College instructors and union trainers say block-release training is beneficial for the majority of apprentices.[10] They learn from a professional instructor, develop peer-to-peer relationships and gain hands-on experience. Learning disabilities can be more easily identified by instructors and appropriate supports provided. For some apprentices and employers, however, block release poses significant barriers:

Rural/Remote Location: The need to move temporarily to access training in an urban centre has been identified as a challenge to apprentices who are unwilling or unable to leave their families. Travel and accommodation costs also create financial barriers.

Financial Hardship: During block-release training, many employers suspend the payment of wages, requiring apprentices to collect Employment Insurance (EI) if they are eligible. Reduced income can present a hardship that may cause an apprentice to delay returning to school in subsequent periods.

---

[6] A definition of "full-time" was not provided. The full label of the response category is "Full year or more / full-time / every day / high school or college program." The question was "mark all as apply" which means some apprentices could have selected "block release" and "full-time" (during the time they were released for training).

[7] Kristyn Frank and Emily Jovic, *National Apprenticeship Survey: Canada Overview Report 2015*. (2017), 60.

[8] Ibid.

[9] Robert Crocker, Trent Craddock, Marjorie Marcil and John Paraskevopoulos, *National Apprenticeship Survey 2007 Profile of Participants*, (2010). http://www.red-seal.ca/docms/nas_profiles_eng.pdf., 14. Updated results not yet available.

[10] CAF-FCA, *The Impact of Technology on Apprenticeship*, (2013)., 24-25.

Employer-Related Barriers: Although jurisdictional apprenticeship authorities attempt to place apprentices in training when it is convenient to employer needs, concerns are expressed across sectors, trades and jurisdictions when it comes to scheduling block-release training. In some cases, employers have noted that training blocks do not recognize business realities, making sending apprentices to school inconvenient to workplace needs. Educational institutions may, as a result, find that some sections are over-subscribed and they are unable to meet demand based on class and instructor resources. Conversely, sections scheduled during busier periods in the sector can be under-subscribed, leading to the cancellation of classes that have an insufficient number of students. Apprentices, concerned about job security when employers are unwilling to release them to attend technical training, may remain in the workplace and defer training.

Low-volume Trades: In some jurisdictions, educational institutions do not offer annual training for trades with low registration numbers in an effort to fill a class and make training more cost effective. This can pose a barrier for apprentices, lengthening the time to complete their training and obtain certification.

Cost of Simulators: For some trades, simulators are required so apprentices can practice their skills in a safe environment, but simulators are expensive for technical trainers to purchase.

5.0 Alternate Delivery

Based on challenges attributed to the traditional block-release model, apprenticeship trainers and apprenticeship authorities have experimented with alternate technical training delivery formats. These include flexible class times, such as day release or night classes, the introduction of mobile training units and training that takes place upfront, online or using simulators. These alternate delivery mechanisms come with benefits and challenges.

5.1 Flexible Class Times

Technical trainers offer classes at night or one day per week to accommodate apprentices who wish to continue working. This is commonly known as "day release" or the "Weekly Apprenticeship Training System" (WATS). No FIATT projects are testing this model. Day release is the only alternate form of technical training delivery that yields a higher probability of completion.[11] Probability of completion was 89 per cent for technical training by day release.[12]

[11] Robert Crocker, Trent Craddock, Marjorie Marcil and John Paraskevopoulos, *National Apprenticeship Survey 2007 Profile of Participants*, (2010). http://www.red-seal.ca/docms/nas_profiles_eng.pdf., 28.
[12] Ibid., 29 and 86.

Night Classes/Day Release	
Advantages	**Disadvantages**
• There is little or no disruption in employment • Larger employers may prefer day release if they have sufficient trainees to meet workplace needs[13] • Those in day release are more likely to complete[14]	• Some apprentices may find it hard to focus on learning after working all day/throughout the week • It can be confusing if training content is unrelated to work tasks • Alternate models may not work for all employers/trades, as some prefer the short-term disruption of block-release for a few weeks as opposed to day release over several weeks[15] • Day-release and night classes are not an option for apprentices if their workplace and training location are not close in proximity

5.1.1 Examples

There are a number of colleges that offer day release for cooks. Employers in this trade are able to predict times and days that will be busy within their weekly schedules. Day release allows apprentices to receive training on slower days in the kitchen.

British Columbia: White Spot restaurants select a cohort of apprentices to take Professional Cook 1, 2 and 3 technical training one day per week over 25 weeks at Vancouver Community College while continuing to work full-time. There is no reduction in training hours.

5.2 Mobile Training Units

A mobile training unit can be driven to a community. Apprentices learn skills in the unit rather than going to an institution. Learning may be completed online and through video-conferencing and/or the use of simulators. Instructor interaction while in the mobile training unit may be in-person or via video conference. Examples of existing programs include heavy-duty equipment technician, welder and heavy equipment operator.[16]

[13] Rosemary Vogt, *EADDI Project Report 2010-2013*. (October 2013)., 6.
[14] Robert Crocker, Trent Craddock, Marjorie Marcil and John Paraskevopoulos, *National Apprenticeship Survey 2007 Profile of Participants*, (2010). http://www.red-seal.ca/docms/nas_profiles_eng.pdf., 28.
[15] Rosemary Vogt, *EADDI Project Report 2010-2013*. (October 2013)., 6.
[16] Ibid.

Mobile Training Units	
Advantages	**Disadvantages**
• The apprentice stays within their community and is able to meet community/family obligations • The apprentice spends less time away from the workplace, benefitting employers who need their apprentices on-the-job	• Mobile training units are expensive to buy, equip, administer, transport and operate • Fewer hands-on opportunities with actual equipment • Limits to onsite instruction or online instructor support may affect apprentice learning

5.2.1 Examples

Overview

A number of colleges, unions and provinces/territories use mobile training units in rural and remote communities.

British Columbia: Nicola Valley Institute of Technology's mobile unit, which has operated for the past four and a half years, consists of two 53-foot custom-built long-box trailers hauled by two semi-trucks. The unit provides 1,100 square feet of training space and enough room for 12 teaching stations. The mobile unit is used to provide Introductory Bridging to Trades training exclusively to First Nations communities throughout the Nicola Valley region and across British Columbia. The mobile program, which enables Indigenous participants to explore and select an apprenticeship trade for further training, consists of essential skills and upgrading assessments, as well as 12 weeks of classroom and practical hands-on experience.

Ontario: Cambrian College runs a mobile trades training trailer, which delivers technical training in a mobile classroom that travels throughout northern Ontario. The mobile trades training facility accommodates 16 trainees at a time and is equipped for instruction in a variety of skilled trades, such as welding, electrical, heavy equipment, truck and coach, machining, and millwright.

FIATT Projects

Nova Scotia: Nova Scotia Community College (NSCC) is increasing access and success for construction and industrial electrician apprentices through the development and implementation of four alternative integrative learning tools. The project includes utilizing the Mobile Learning Centre (MLC) in remote areas throughout the province, designing and building approximately 196 mobile training simulators, re-designing all 33-theory courses using an interactive online learning platform and, creating a mobile web-based broadcast unit accessible to faculty, industry and apprentices. Each of the learning tools functions independently and/or can be combined in multiple ways to enhance learning. For example, the mobile training simulators can be used by

apprentices in the MLC, a campus classroom or employer boardroom. The recorded web-based broadcasts are an additional learning resource for Desire2Learn (D2L). Apprentices have access to the tools as they are developed. Apprentices are currently enrolled in level two and level three theory courses in D2L, are using the new mobile training simulators and the MLC has travelled to serve apprentices in two remote communities. These four alternative approaches to technical training are expected to reach up to 80 apprentices in Nova Scotia and an additional 5 in Prince Edward Island.

New Brunswick: A mobile welding lab is allowing New Brunswick Community College to conduct outreach and promotional activities, targeting rural and underrepresented students, including those in First Nation communities.

5.3 Upfront Training

Some programs allow the apprentice to complete technical training upfront, before working on a job site.

Upfront Training	
Advantages	**Disadvantages**
• The employer does not need to release the apprentice and the apprentice continues to work, causing less disruption to the employer's schedule • In technologically intensive trades, employers may prefer apprentices to complete theoretical training before coming to work because it ensures they have the background knowledge required and can be more immediately productive • Employers express concerns about the lack of foundational skills and commitment to the trade. Completing technical training proves the apprentice has gained foundational knowledge and, over that time, has demonstrated interest in their trade	• The costs of upfront training (tuition, living costs) are generally borne by the apprentice • It may be difficult for the apprentice to retain theoretical learning without practicing it in the context of the workplace. Work experience can reinforce complex theoretical concepts • The gap between technical training and the certification exam may impact pass rates • No guarantee of job availability once training is completed • In some trades, effective learning is reliant on working in realistic conditions (e.g. outdoors in inclement weather)

5.3.1 Examples

Overview

Quebec: Technical training occurs upfront. The apprentice then secures an employer sponsor and completes their hours. This approach to training is especially prevalent in the construction

industry where it is a condition of admission to apprenticeship. For the non-construction trades, Emploi-Québec does not require the apprentice to have done training before the apprenticeship so for most apprentices the training is done during the apprenticeship, not up front.

FIATT Projects

Alberta: Red Deer College is offering community-based, upfront technical training in the welding trade, beginning with simulator training in the home community of their First Nations partners, as a part of its pilot project. The remainder of the cohort preparation includes on-campus training, online learning, innovative testing models, personal development and a co-op work placement model.

5.4 Online

Online training, also known as "e-learning," is computer-based. A number of the FIATT pilot projects are experimenting with online learning. Technical trainers have experimented with a variety of online formats:

Traditional online courses: Courses are self-directed and completed online. Generally, there are pre-set timelines in which modules must be completed.

Self-paced: Online courses are completed online or at an institution to which the apprentice can come when it is convenient to use a designated study room. An instructor can be accessed for guidance and support.

Distance blended learning: Online courses are offered with the capacity to connect with a classroom. A video camera allows apprentices in rural or remote locations to see what instructors are demonstrating.

Hybrid: Hybrid models combine online and classroom learning, with part of the coursework completed online and the rest in a classroom.[17] Educational institutions have experimented with the proportion of time spent on each component, with some splitting the time equally and others limiting classroom instruction. The ideal split is unclear and may depend on the trade or the apprentice. Many instructors prefer a hybrid model to online learning alone, with a majority of the FIATT pilots implementing this approach.

[17] Institutions may use different terms when referring to online learning programs.

Online	
Advantages	**Disadvantages**
• For employers, online training minimizes operational disruptions for technical training • Online learning may reduce costs for government by reducing or eliminating the need for EI or student loans • Online learning enables apprentices to continue earning regular wages • For training deliverers, online learning reduces reliance on classroom space • Employers may prefer apprentices to learn online to support future training by original equipment manufacturers and industry associations[18] • Apprentices learn at their own pace and may review concepts repeatedly[19]	• Computer skills, superior self-discipline and an environment free of distractions are required for online learning • IT expertise to develop and amend curriculum can be costly[20] • Copyright may prevent the incorporation of materials developed by others • Many apprentices are challenged by returning to school after years away from formal learning making the support and mentorship of an instructor and peer-to-peer learning critical to success.[21] Some may find online learning isolating. • Apprentices need to be screened for their capacity for e-learning • Some instructors are skeptical about capacity to provide appropriate supports via email or other technology, putting the learning process at risk[22] • There is some evidence to suggest higher non-completion rates among online students[23] • Gaining instructor support can be challenging

5.4.1 Examples

Overview

In Canada, colleges and provincial apprenticeship authorities have instituted e-learning options or initiated pilot projects.

[18] See CAF-FCA, *The Impact of Technology on Apprenticeship*, (2013)., 12.
[19] Rosemary Vogt, *The Growth of Alternate Delivery in Canadian Apprenticeship Trades: 2008-2013*, Red River College, (October 2013)., 16-20.
[20] CAF-FCA, *The Impact of Technology on Apprenticeship*, (2013)., 25.
[21] Stephen Downes, *The Future of Online Learning* - Chapter Eight "The Economics of Online Learning" (2004).
[22] Joan Cashion and Phoebe Palmieri, *The secret is the teacher: The learner's view of online learning*, NCVER, Australia, 2002.
[23] Di Xu and Shanna Smith Jaggars, *Online and Hybrid Course Enrolment and Performance in Washington State Community and Technical Colleges*, Community College Research Centre, Teachers College, Columbia University, CCRC Working Paper No. 31 (March 2011).

Alberta*:* SAIT Polytechnic implemented a pilot project with automotive service technicians to ascertain the efficacy of e-learning.[24] Apprentices completed the theory components of their in-school training online and the lab or workshop courses at SAIT. The online material used 3-D software applications and animation. Online material was available on demand and apprentices studied the material at their own pace. Instructor support was available via email or apprentices could ask for help when they attended labs.[25] SAIT's blended model delivered 80 per cent online and 20 percent in a shop setting. Apprentice grades were assessed prior to entering the program. The pilot found the online apprentices performed equally as well as traditional block-release cohorts. SAIT extended the blended learning model to the welding, plumbing and electrical trades.

British Columbia*:* During the first two levels of the Recreation Vehicle Service Technician apprenticeship program at Okanagan College, safety and other generic topics are delivered via online training, with a practical portion done on-site at the college. For the first year, the format is three weeks online and five weeks on-site; and the second year is two weeks online and six weeks on-site. In the third year, the format is eight weeks on-site, with no online component. In the initial delivery of an online format, the college had included online instruction in all three years; however, they found that there was a drop in the interprovincial Red Seal pass rate because online training did not work well in third year due to an increased technical focus. The issue was corrected by removing the online portion and using only on-site instruction for the third year and the interprovincial pass rates have returned to their previous levels.

New Brunswick: In the refrigeration and air conditioning mechanic trade, "virtual classroom" technology is utilized to reduce time in-class for commuting students. Students return home on Thursday and, on Friday, join the virtual classroom. Students are satisfied with this delivery strategy as it reduces their accommodation costs.[26] This system allows apprentices to be home a day earlier if they are travelling for training.

Welder training at the Collège communautaire du Nouveau-Brunswick (CCNB) Bathurst is delivered online to allow for Francophones from all over Atlantic Canada to take their level training without having to travel.

---

[24] The pilot project is described in Darwin Schatz, *Final Report: Blended Learning for Apprentices*, (2009).

[25] The blended model is described in a YouTube video: http://www.youtube.com/watch?v=KaPttvF774A. Additional information is provided in: SAIT - Apprenticeship Blended Learning Programs: http://www.sait.ca/programs-and-courses/apprenticeships-and-trades/apprenticeships/additional-information/apprenticeship-blended-learning-programs.php; Lionel Shewchuk, "Delivering Apprenticeship Training in a Blended Online Learning Environment". Presentation at CAF-FCA 2012 Conference (June 5, 2012) and Martha, Burkle "Designing E-learning in Virtual Worlds for Apprenticeship Students in Canada". Paper presented at International Conference on E-Learning (ICEL), (New York, New York, U.S.A., June 9-11, 2010).

[26] CAF-FCA, *The Impact of Technology on Apprenticeship in New Brunswick*, (2014)., 22.

Ontario*:* Durham College and Sault College offered a hybrid model for industrial mechanics/millwrights. The online course was supplied by Durham College and the shop training portion was offered by Sault College. The hybrid program was created for apprentices in remote areas of northern Ontario, with the aim of reducing the amount of time spent in Sault College residence. The online course was also available to Durham College students. Durham College also partnered with the Construction Millwrights Union Local 2309 to provide online theory and weekly practical training to union members in return for equipment access.

FIATT Projects

Alberta: The Diesel Engine Technology (DET) program trains learners at Portage College in engine fundamentals, service and repair, engine systems, diesel fuel injection systems, electronic fuel management and heavy duty charging and cranking systems. The unique delivery provides learners flexibility to retain employment while accessing quality training. The blended method of delivery is comprised of 12 weeks of online theory followed by four weeks of face-to-face practical training. Upon successful completion, learners have the option to challenge the provincial apprenticeship exam.

British Columbia: The British Columbia Institute of Technology is offering hybrid learning (online, plus time in the classroom). Trades included are gasfitter A and B, steamfitter/ pipefitter, plumber and refrigeration and air conditioning technician. The college is addressing some of the difficulties associated with online learning through these strategies:

- **Isolation**: There are instructor-led sessions and real-time contact with the instructor to overcome apprentice isolation. Forums for apprentice interaction are set up with both structured and unstructured tasks for online classes to complete.
- **Time Management**: Messages remind apprentices of upcoming deadlines.
- **Engagement**: Web-based simulations, videos and animations ensure the learning is interactive and engaging.

Thompson Rivers University is offering pipefitter apprentices who are unemployed or changing careers opportunities to complete the upper levels of their training in an accelerated manner with a combination of online learning and in-class labs.

New Brunswick: New Brunswick Community College is offering half of the technical training online for the refrigeration and air conditioning mechanic and welder trades.

Nova Scotia: Nova Scotia Community College is offering training online in the construction and industrial electrician trades. This training is open-entry, meaning that someone can start and finish at any time with a 90-day time limit per course.

Ontario: Collège Boréal and Lambton College are implementing a pilot project for carpenter and heavy-duty equipment technician apprentices. The courses have online and classroom components. Material is provided in French and English.

Saskatchewan: Saskatchewan Polytechnic is implementing a pilot project with a hybrid learning model. Trades include construction electrician, plumber, heavy-duty equipment technician and truck and transport mechanics. The aim is to make learning highly interactive with faculty so learners benefit from instructor advice and guidance and do not feel isolated. To create greater connections between the online learning and on-the-job training, apprentices are assigned homework requiring them to ask their supervising journeypersons questions. The responses are integral to online class discussions.

Yukon: Yukon College is offering online and on-site technical training in the carpenter, oil heat system technician, gasfitter, heavy-duty mechanic, plumber and automotive service technician trades, creating greater access to training for Indigenous and Northern/rural apprentices. The intake of participants is continuous and are based on matching an apprentice with an instructor and tutor in a northern community upon request.

5.5 Simulators

Simulation technology is an immersive learning experience that replicates the actual physical tasks associated with developing a new skill. This technology develops both technical skills and dexterity skills. It is used in welding, gas technician, vehicle operation, heavy equipment operation and spray-painting trades.[27] Both colleges and industry-based training centres in Canada are investing in simulation technology.

[27] Rosemary Vogt, *The Growth of Alternate Delivery in Canadian Apprenticeship Trades: 2008-2013*, Red River College, (October 2013)., 16-20.

Simulation Technology	
Advantages	**Disadvantages**
• Simulators are safe for early-stage learners. Errors are detected and corrected before they become embedded habits. Apprentices can also practice without causing harm to themselves or others, reducing safety risks. • Some instructors say apprentices learn dexterity skills faster when using simulation technology. Learning is supported because tasks become progressively more challenging. • Simulators do not consume energy, fuel and materials like actual equipment. Operating costs may be reduced.	• Simulator technology is expensive and not all technical trainers are positioned to make the investment. • Some instructors believe that any teaching strategy that departs from using actual machinery and equipment weakens the practical orientation of apprenticeship training.

5.5.1 Examples

In some jurisdictions, there is significant industry or government support for the increased use of simulation technology in apprenticeship training.

FIATT Projects

Ontario: The Operating Engineers Training Institute of Ontario purchased new crane simulators for mobile and tower crane operators as a part of its FIATT pilot project. Apprentices spend an additional 60 hours of seat time operating either the actual crane or the related crane simulator. A historic and current performance tracking database is available so apprentices can track how they are doing in comparison to others. By moving more complex employer-driven training scenarios from the theory portion to the practical portion, apprentices have the opportunity to rehearse difficult and/or dangerous scenarios in a safe and controlled environment. The Operating Engineers worked with employers to design these scenarios to ensure the skills learned are transferable to real-life conditions.

Nova Scotia: Nova Scotia Community College is using simulator training in wiring methods, motor controls, fire alarms, communication wiring systems, industrial wiring, pipe bending, programmable logic control, mobile basic electrical and electrical troubleshooting.

New Brunswick: New Brunswick Community College is using a virtual reality arc welding training system as a part of its FIATT project.

Alberta: Red Deer College is using simulator training (virtual reality arc welding training system VRTX 360) in their mobile training labs as a part of the FIATT pilot.

6.0 Conclusion

This article outlined the difficulties some apprentices and employers experience with traditional technical training, such as financial hardship, inaccessible training and inconvenient scheduling. Alternate delivery models address these problems and aim to facilitate progression and skills development. Forms of alternate delivery include alternate class times, mobile training units and upfront, online and simulator training.

These alternatives may be more convenient for the apprentice and employer, reducing financial barriers and creating accessible training for under-resourced communities. A key benefit for employers is apprentices remain at the workplace. The quality of the learning experience remains of paramount concern for apprenticeship stakeholders. After working all day, some apprentices may struggle to concentrate on their night, day or online courses. Their performance may be impacted by isolation due to a lack of instructor or peer interaction.

While upfront training enables the apprentice to gain knowledge and then work continuously, complex theoretical concepts may not be reinforced at the workplace. The equipment, administration and development costs associated with mobile training units, simulators and online courses are additional challenges. Offering a combination of online and classroom training, greater online instructor interaction, online peer forums and greater employer engagement in technical training are just some innovative solutions technical training institutions are implementing to facilitate quality apprentice learning.

The FIATT pilots are supporting greater experimentation with alternate delivery in a variety of trades. These experiments consider the potential benefits for apprentice progression, completion, skills development and engagement with learning. Promising practices from the FIATT pilot may inform and shape future alternate delivery approaches and apprentice learning strategies.

About the Author:

Dr. Emily Arrowsmith, Canadian Apprenticeship Forum

Emily has implemented 25 national apprenticeship research projects over her 10 years as a project manager and researcher at the Canadian Apprenticeship Forum. She is the Project Manager for the *Flexibility and Innovation in Apprenticeship Technical Training* project and is responsible for producing an environmental scan about alternate delivery initiatives across the country, overseeing an evaluation strategy, implementing an apprentice survey and writing a summary report about the costs and benefits of technical training. She has a Ph.D. from Carleton University.

Mohawk College Pilots Innovative Instructional Technology

Angelo Cosco, Mohawk College

For fifty years, Mohawk College of Applied Arts and Technology, located in Hamilton, Ontario, has brought educational opportunities to the residents of Ontario's Golden Horseshoe. The area is densely populated and highly industrialized region on the western shores of Lake Ontario that includes the cities of Hamilton, Brantford, Burlington and surrounding communities. As one of the largest providers in Ontario of the in-school components of apprenticeship training, Mohawk College serves more than 2,400 apprenticeship students annually and offers 17 apprenticeship programs, most of which are delivered at the Stoney Creek Campus for Skilled Trades, located in Stoney Creek.

In addressing this pivotal educational role, the staff of the Faculty of Skilled Trades and Apprenticeship have developed keen insights into the challenges associated with meeting Canada's need for highly skilled workers. With strong ties to business and industry in the region, college staff know first-hand the difficulties experienced by today's employers in recruiting sufficient numbers of highly skilled tradespersons. In addition, college staff are particularly attuned to barriers and issues encountered by apprentices. In low volume trades, apprentices frequently experience significant delays in completing their study because training cannot be offered on a regular basis. Those in more remote or rural areas often struggle to access the training they need, and often have to contend with additional housing and/or transportation costs to reach training centres. Additional financial hardships can arise when defined scheduling options like block release necessitate interruptions in employment. All of these pose delivery challenges for the college and can have significant impact on apprenticeship completion rates.

In recent years, educational institutions have turned to computer-based learning options as increasingly popular solutions for some of these issues. E-learning options enable apprentices to study where and when they choose. However, for the most part, computer-based delivery solutions have focused primarily on the theory components of apprenticeship curriculum in a hybrid delivery model that combines computer-based learning with traditional classroom/shop instruction. Delivery of the practical elements of the curriculum has been tied to shop or lab facilities. Unfortunately, this delivery strategy brings with it the challenges noted earlier. However, emerging technologies may offer new solutions to these challenges. The Construction and Building Systems department in the Faculty of Skilled Trades and Apprenticeship at Mohawk College is currently engaged in a pilot project that will explore new technology applications in the delivery of lab/shop-based apprenticeship training, using a model that has the potential to accommodate full distance education delivery of the in-school portion of apprenticeship training.

In 2016, the department received approval and financial support from the college's Applied Research and Innovation in Education (ARIE) fund to explore the use of Microsoft HoloLens technology as an assistive device for online and classroom learning. Using the HoloLens, the project will investigate applications involving augmented/mixed reality as a teaching/learning strategy for delivery of apprenticeship curriculum. Initially, the Instrumentation and Controls Technician Program (447A) has been selected for this research pilot.

The Instrumentation and Controls Technician Program (447A) represents an excellent opportunity for examining the benefits of this new technology in addressing barriers associated with accessibility, financial hardship and scheduling. In recent years, it has been an underutilized program. For several years, because of low enrolment, the Faculty of Skilled Trades and Apprenticeship, working with the Ministry of Advanced Education and Skills Development, has struggled to run one class of 16 – 20 students annually for this trade. As a result, it is difficult to meet the demand from local employers for trained apprentices. Apprentices waiting to begin their training or those looking to complete subsequent levels of apprenticeship program 447A frequently have to wait longer for a class to become available than apprentices in other trades. Since Instrumentation and Controls Technician is a Red Seal trade, the ability to use technology in the delivery of both theory and practical components of program 447A could enable Mohawk College to collaborate with other regions and provinces to increase the pool of qualified apprentices across Canada. If this new technology application proves to be effective, apprentices, wherever their location, will be able to access both theory and practical training locally, thereby eliminating geographic and financial challenges.

As an innovative augmented/mixed reality technology, Microsoft HoloLens enables users to immerse themselves in a fully interactive, holographic experience while maintaining contact with people and objects within the real world. This relatively new, wearable technology allows users to visualize and work with digital content as part of their real world and simultaneously share ideas with others. The ability to move naturally, and interact and explore in three dimensions offers a digital experience that enables users to feel fully present in their environment. Unlike older virtual reality technology which replaces the real world with simulations, HoloLens overlays its digital applications onto the real world. This means that with this mixed reality technology, for example, a user is able to create a virtual ball that can drop off a table or bounce off the walls, enabling real-life practice with that ball.

Understandably, the technology has been very popular with gamers but, to date, educational applications have not received significant attention. However, since users can view and interact with projects, assemble 3-D models and watch live content, it would appear that the technology could offer excellent potential for delivering the in-school practical components of apprenticeship training. As a potential application, for example, an instructor could place a virtual motor in the middle of a room. Students wearing the HoloLens would be able to see the

motor, and walk around it, since it occupies real space. In addition, they would be able to pull out internal components of the motor and examine and interact with them separately, tasks which are not easily accomplished with a real motor.

At a current cost of approximately $3,000 per unit, the HoloLens is a relatively inexpensive technology. In addition, with advances in technology, it is likely that this equipment will become even more affordable. The unit, which consists of a head-mounted display, connected to an inner headband, incorporates high definition lenses and spatial sound technology. With a completely self-contained computer built into the head set, the HoloLens requires no PC connections or external hardware. Battery power ensures 2- 3 hours of active use and two weeks of standby power. In addition, the unit can also be used during charging. These relatively simple operating parameters will support delivery at a variety of locations, remote from the College. The processing unit recognizes gaze, gestures and voice inputs, and integrates Skype applications, facilitating real-world communications. This represents a significant advantage for teaching/learning applications, enabling student-to-student and faculty-to-student interactions in real time, and thereby facilitating a more realistic virtual shop or classroom experience.

To date, as part of the initial development phase of the research project, the Construction and Building Systems Department has purchased two HoloLens devices and installed the appropriate Unity 3D software required for its operation. Other equipment requirements include a computer system that can support 3-D graphics editing and modeling and a Microsoft Pro Surface 4 tablet that enables the instructor to manipulate the work environment. Project staff are currently engaged in research activities focused on developing and refining images that will work with the HoloLens as a preliminary step in the development of curriculum units for pilot delivery of the 447A curriculum. As one of the first project activities the project team has focused on the design of an AC electrical motor, using the Unity software.

College staff have partnered with Webility Solutions, a Hamilton-Ontario based web-development company dedicated to building high-quality custom web and mobile applications. The Webility team will collaborate with college project staff to design HoloLens applications to address the learning outcomes that comprise the practical, in-school portion of the apprenticeship program. Webility project staff will assume responsibility for the technical components of the application, setting up the virtual models and programming the interactions between them. Mohawk College staff will guide the development of the project, specifying learning objectives and the specific applications required for students to learn and demonstrate mastery of the practical skills. Faculty involved in the project all have experience with blended learning, but will need to develop familiarity with the HoloLens technology and its capabilities, and delivery of practical training using computerized images.

Since its inception, Mohawk College has maintained close ties with employers in the community, seeking their input to maintain curriculum relevance and validity. This project is no exception. Feedback from the employer community will be an important component both in the development phase and in evaluation of project results. Program Advisory Committee members will have an opportunity to contribute to the design and development of curriculum units. In addition, employer representatives will be recruited to participate as members of curriculum review teams to ensure that the technology-enabled curriculum is aligned with work practice and workplace needs. Pilot delivery will initially focus on Level 1 of the Curriculum Standard and, assuming successful outcomes, will eventually be expanded to include Levels 2 and 3 of the training, and potentially other trades. There may also be the opportunity to integrate Prior Learning Assessment and Recognition into the learning strategy, enabling apprentices to earn credit for practical skills that they already possess - soldering, for example.

Use of the HoloLens technology will enable the apprentices to develop a variety of practical skills specified in the 447A Training Standard including assembling semi-conductor circuits, using electrical test equipment, building basic logic circuits, and calibrating pressure, temperature, level and flow transmitters. Webility and Mohawk College staff will initially collaborate on the development of a virtual pressure instrumentation lab panel, with gauges, transducers and semi-conductors. This panel will enable apprentices to virtually connect and build circuits, perform a variety of tests, and complete required lab/shop assignments. Apprentices will be able to connect a compressor to a pressure gauge, for example. When the compressor gauge is opened, the lab will simulate the pressure in the system and all the components will react in real time to the pressure. Apprentices will have the opportunity to test different methods of connecting pressurized equipment to develop an understanding of how the systems work and interact.

Unlike traditional shop settings where there are time constraints, this technology-enabled solution will allow apprentices opportunities for repeated practice and mastery of the required skills. In addition, they will be able to work and learn in a completely safe environment, without concern for damage to person or property. The technology also supports real-time interaction between students and the instructor, even at a distance. The instructor can view what the student sees and is doing, offer advice and corrections as necessary and, at appropriate intervals, assess student performance.

Since this technology has the potential to transform the delivery of the in-school portion of apprenticeship programs, not only at Mohawk College, but within the college system as a whole, college staff are eager to share project details. As the first formal opportunity for knowledge transfer, Mohawk College gave a presentation at Queen's Park on April 3, 2017 as part of the *Creativity Zone* event hosted by Colleges Ontario. The Project Team represented the college in the Experiential Learning category, with a demonstration on Augmented and Virtual Reality

technology. Attendees included the Ontario Minister of Advanced Education and Skills Trades Development, senior politicians, Ontario government deputy ministers as well as other members of the Ontario civil service.

In addition, project staff members gave a presentation at the *Reality Check Advancing Learning Conference 2017* held on May 17 and 18, 2017 at Mohawk College. The conference, organized by the Educational Technology Committee of the Ontario College System, is Ontario's premier instructional technology conference. The conference represents an ideal venue for college faculty, instructional designers and multimedia and graphics specialists to share issues and experiences related to digital tools, digital learning environments and engaging students in technology-enabled learning.

Pilot delivery of the Instrumentation and Control Technician curriculum is scheduled to begin in Fall 2018. The technology will be modeled in both the traditional classroom/shop environment and at remote locations. Although delivery details have not yet been finalized, it is anticipated that apprentices who are geographically remote from the college will be able to access the equipment at a local Ministry office; alternately, the college may make use of the Contact North distance learning network, ensuring access for users in more isolated northern parts of the province. Theory components of the apprenticeship program will be delivered using E-Learn, the college's distance education network. Such an arrangement should ensure equitable access for groups of students who are traditionally underrepresented in apprenticeship training including women, Indigenous people and residents of geographically remote communities.

The HoloLens is an exciting and innovative technology that appears to offer significant promise for enhancing the teaching and learning environment. Apprentices participating in this pilot project will have the opportunity to review and reinforce both theory and practice in critical content areas, with the potential for a penetrating and intense learning experience that exceeds the degree of exposure to equipment and processes currently available in traditional approaches to apprenticeship. Another significant advantage is that apprentices are not required to be physically present in the shop or lab while this learning takes place, thereby eliminating many of the geographic and financial challenges currently experienced by some apprentices.

As a result, the project team anticipates that this technology will enhance delivery efficiencies, while developing apprentice comfort levels with cutting edge technology – a significant advantage as workplaces and work responsibilities become increasingly automated. A comprehensive, structured evaluation strategy is planned with careful review of project outcomes to determine:

- **The impact of the technology on student performance:** Program 447A includes content that is complex. Evaluation of the effectiveness of a fully technology-enabled

solution in developing competent and confident apprentices with the requisite skill levels is an important input for decisions regarding future use of the technology.

- **The level of user satisfaction and comfort levels with the technology:** Mixed/augmented reality introduces a new dimension to the learning process that does require acceptance and the ability to master the technology. Ease of use is important criterion for subsequent decisions regarding the incorporation of this specific technology into the learning environment. In addition, on completion of the training, it will useful to acquire feedback from apprentices on their level of confidence and their impressions of their own workplace-readiness, as the result of their exposure to this new technology. Since delivery will be piloted both in the more traditional, college-based shop environment and at remote locations, it will be possible to evaluate the impact of distance on the learning experience and the level of confidence noted by users.

- **The impact on accessibility:** This project represents a new step forward in introducing technology-enabled learning to address the practical components of apprenticeship training that traditionally have been covered in a lab/shop environment. This pilot will test the validity of the assumption that computer-based learning solutions that remove the requirements for physical presence in a classroom or shop/lab will eliminate current geographic and financial barriers and increase the participation of traditionally underrepresented groups in apprenticeship study.

- **Levels of employer satisfaction:** Employer acceptance of this new approach to training is critical to continued use and future applications of this technology. Workplace follow-up will serve as an important element in evaluating the success of the project. Employers will be able to provide valuable feedback on 'workplace readiness' and the skill levels of apprentices trained with this new technology. It is important to determine if the apprentices are able to transfer the learning and skills development provided with the use of the HoloLens to the workplace environment. It will also be interesting to compare apprentice perceptions of their own abilities and employer perceptions.

The data collected during this pilot delivery will have significant impact on decisions regarding the transferability of this technology to other trade areas. Assuming positive outcomes, the project will be invaluable in formulating effective strategies and best practices for integrating new digital applications into the teaching and learning environment.

About the Author

Angelo Cosco, Mohawk College

Angelo is Associate Dean of Construction and Building Systems at the Marshall School of Skilled Trades & Apprenticeship at Mohawk College. He joined Mohawk College in September 2006 after a 22-year career as a Red Seal journeyperson in the motive power sector. While at Mohawk College, Angelo has served as a technologist, professor, Program Manager and Industry Liaison promoting partnerships with local communities and industries.

Discovering Innovative Solutions to Trades Training Across BC

Gary Herman, Industry Training Authority

Who we are

ITA leads and coordinates British Columbia's skilled trades system. We work with employers, employees, industry, labour, training providers and government to issue credentials, manage apprenticeships, fund programs, set program standards and increase opportunities in the trades. ITA funds 15 public post-secondary and 25 non-public training providers, and provides more than 100 apprenticeship training programs in BC, including programs for 50 Red Seal trades.

The BC Government is committed to building a skilled workforce to ensure that British Columbians have the skills they need to be first in line for the many opportunities emerging across the province, and ITA is helping to achieve this goal. Because of this, we are industry-driven, highly responsive to labour market needs and are aware of and adapt to the changing needs of trades training.

What innovation means to ITA

ITA has defined innovation as new and unique ways to reduce barriers and improve outcomes, including flexible technical training delivery, regional access, student supports and partnerships. Our goal with approaching innovation in this way is to explore, discover and create models that will help us to improve the skilled trades training system in BC. These desired outcomes include improved access to on-the-job training, increased numbers of apprentices entering the system and completing their training, increased geographical access to training, less time away from the workforce for technical training (not reduced total apprenticeship training time), improved completion rates, reduced delivery costs and more training opportunities for targeted demographics.

Labour Market Outlook

We know that by 2025, BC will have nearly one million job openings due to retirements and economic growth, almost eight out of 10 of these jobs will require post-secondary education or training. Ability to fill these openings with skilled trade workers will require apprenticeship training. We also know that a growing economy demands more infrastructure, including the construction of new buildings – industrial, commercial and residential. There are currently more than 360 major capital projects worth almost $80 billion under construction across BC.

ITA is tackling these labour market demands head-on by employing insight-driven strategies, creating collaborative partnerships and delivering quality trades training to connect the right people with the right skills at the right time with jobs across the province. However, this important undertaking is not without its challenges. With over 100 different skilled trades in BC, the needs and challenges across the trades, industries and regions can vary greatly.

Apprentices often face challenges and barriers to completing their certification, such as long commutes to training providers, inconvenient training schedules, financial hardships or limited training opportunities for low-volume trades. Employers also face obstacles as sponsors of apprentices, including scheduling conflicts due to the time apprentices need to be away from the workforce for training, trying to keep up with the changing nature of trades (i.e., evolving technology, equipment and techniques) and the demands of operating a business, especially for smaller businesses and certain sectors. These barriers to trades training require innovative, often customized approaches to improve outcomes and success rates for all those involved.

In response to these challenges, ITA has made it our mission to learn more about the needs of apprentices and employer sponsors in British Columbia, to offer appropriate solutions. We want to explore, develop and apply innovative approaches to trades training, because we know innovation has the power to strengthen BC's apprenticeship system, which is vital to the overall growth of the province. The continual exploration and development of innovative solutions for trades training will allow ITA and the province of BC to stay ahead of the curve, facilitate program completion and ensure we keep workers in line for job opportunities.

What has already been done?

In 2015, the *Skilled Trades Innovation Forum* was hosted by ITA in partnership with the BC Ministry of Jobs, Tourism and Skills Training. This event brought together nearly 400 attendees including leaders from training institutions, the K-12 system, First Nations communities, employers and other stakeholders to exchange ideas, share information and learn best practices. The theme of the event was 'Creating a Culture of Innovation,' which provided participants with the opportunity to discuss topics ranging from regional training, creative approaches to training, leveraging technology to improve apprentice experience and mobility of apprentices and skilled workers.

The outcome of the forum was the development of the *Innovation in Skilled Trades Training and Apprenticeship in BC Report*, which outlines examples of innovative practices involving flexible delivery, regional access, student supports and partnerships. This report not only acts as an inventory of current innovative practices across regions, but was also developed to inspire best practices to help improve future outcomes in trades training.

Where are we going?

Over the past few years, ITA has taken what we have learned and kept a pulse on what is still needed in terms of innovative training delivery. We have continued to uncover and explore the different ways in which innovative approaches can make trades training better. We have forged new partnerships to bring technical training to remote First Nations communities, introduced self-contained mobile trades training units to extend the reach of quality training to remote communities and, most recently, have launched pilot projects across BC focused on improving regional access and flexible delivery of training.

1. Indigenous Carpentry Training Program

To reduce barriers associated with trades training accessibility and to redefine Indigenous home building in their own territory, ITA worked with BC's Bella Coola Nuxalk First Nation and Camosun College to bring technical training into the community for carpentry apprentices.

Training Provider	Apprenticeship Program	Number of Students
Camosun College	Carpenter	28 students

Participants ranged from 17 to 44 years of age, and included Grade 10/11/12 students from Acwsalcta School, Nuxalk Nation's K-12 school.

Goal & Objective:

The community identified a two-pronged need: 1) to improve carpenter apprentice outcomes among the Nuxalk people, and 2) to construct new homes and buildings for the community that would be built by their own people and constructed to suit the economic, social and cultural needs of the community. The program was designed to create a new vision and perspective for the community on how to manage, be responsible for and take pride in the ownership of their assets. In support of this objective, information and resources on home maintenance were supplied by the Canada Mortgage and Housing Corporation (CMHC).

Outcomes:

To date, participants of this program have built six energy-efficient homes within the Nuxalk First Nation. These family homes have been developed and designed with barrier-free concepts and use resources from the community, such as lumber and stones from the gravel pit, to minimize building costs. Additionally, the construction of a new youth centre has also begun.

Another outcome of this successful, innovative program was construction cost savings. Because the homes were built by the Nuxalk people, this helped to reduce costs for the community overall: $120 per square foot, versus $350 per square foot if outside contractors were brought in.

Looking forward, the plan is to build 50 to 60 homes over the next five years. Nuxalk First Nation has also identified tourism as an economic opportunity and plans to build a Big House in support of that, as well as a restaurant. The construction of these buildings will aid the community's housing need and supply sufficient work for the carpenters trained through the program.

Nuxalk First Nations Carpentry Training Program participants

House on Nuxalk First Nation built by program participants

Conditions for Success & Key Learnings:

In order for this program to be successful, a number of essential factors were identified and established in advance of the launch of the program. The conditions for success were:

- A champion in the community was needed to direct and manage the program
- A long-term commitment from the First Nation and Nuxalk education board was instrumental in order to establish consistent support and build capacity within the community
- Certified Red Seal carpenters from the community were required to work with apprentices and provide supervision – Nuxalk currently has five Red Seal carpenters
- Sufficient work needed to be available in the community for each apprentice to get their hours of work-based training completed
- Accessibility to an ITA Apprenticeship Advisor was required to help navigate program requirements and access resources
- A long-term commitment from partners was essential. For Nuxalk First Nation this included support from the Aboriginal Skills Training and Employment (ASET), FN Housing, suppliers (Rona), the Industry Training Authority, Camosun College and Acwsalcta School

A key learning from implementing this program within the community was that by reducing the time and distance the apprentices needed to travel to complete training, they had their family support systems in place and were able to be home every night. In addition, the class bonded and supported each other throughout the program because they were focused on the same goal in support of their community.

Future Plans:

Based on the success of this innovative program, the Nuxalk First Nation has developed a long-term goal of becoming a Central Coast Trades Centre and would like to have current apprentices ultimately become instructors for the program. The Nuxalk First Nation also plans to build housing for other communities within the northwest region of BC, using Nuxalk-developed building plans and by sharing construction and learning templates applicable to life on the wet West Coast.

2. Mobile Training Units

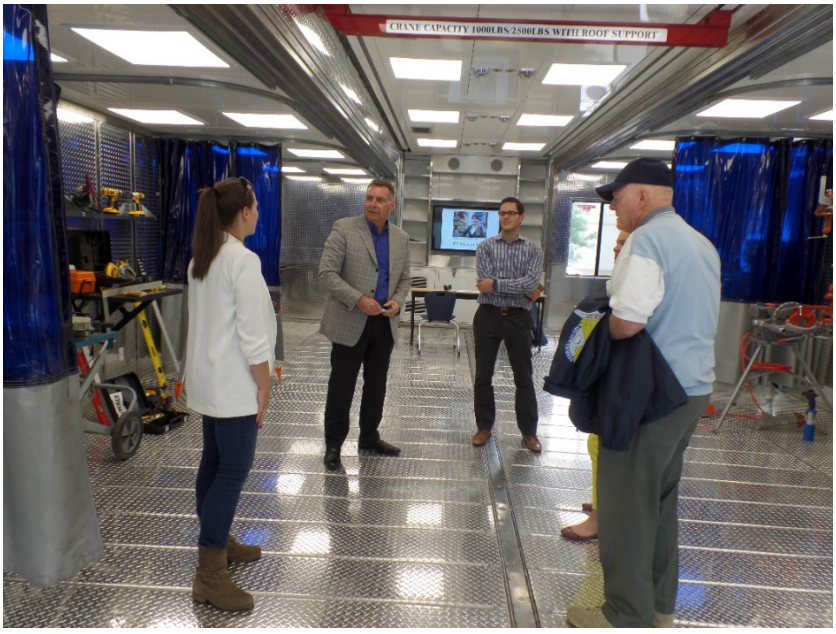
ITA has helped to support the development and deployment of state-of-the art mobile trades training facilities to make trades training more accessible to remote communities around the province. With the labour market rapidly changing as a result of new industry demands, it is imperative that mobile trades training programs are available for remote locations across the province to ensure all communities have access to quality training. To date, three mobile units have been made available for apprentice welders and heavy equipment operators and to provide foundational training exclusively to First Nations communities.

Mobile Training Unit Champions:

Thompson Rivers University (TRU)	TRU has a 53-foot custom-built long-box trailer with pull-out sides that is equipped to hold 12 welding stations. Hauled by a semi-truck and fully self-contained with its own generator, the unit can run for up to a month in a remote area on its own fuel.
Northwest Community College (NWCC)	NWCC has a mobile training unit that provides skills training to rural, remote and Indigenous communities throughout B.C.'s Northwest region. This unit breaks down geographic barriers and give students the opportunity to work with state-of-the-art equipment that will help them achieve stable employment in a prominent trades sector. This mobile training unit is customized to provide a hands-on training environment for a number of trades programs including welding, carpentry, pipefitting and electrical. This flexibility allows NWCC to quickly respond to the high-priority needs of industry and communities, providing students with relevant training to fill in-demand jobs in specific fields. NWCC also has two 30-foot self-contained teaching units, hauled by a pickup truck, that allows for foundation-level heavy equipment operator training in remote areas of Northwest BC. The mobile unit, a simulator housed in the back of a large trailer, provides a safe and reliable environment for training while reducing wear and tear on regular machinery by students.
Nicola Valley Institute of Technology	Nicola Valley Institute of Technology's mobile unit, consists of two 53-foot custom-built long-box trailer hauled by two

	semi-trucks. The unit provides 1,100 square feet of training space and enough room for 12 teaching stations. The mobile unit is used to provide Introductory Bridging to Trades training for electrical, plumbing/pipefitting, machinist/ millwright and welding programs, exclusively to First Nations communities throughout the province.

Northwest Community College Mobile Unit (exterior)



Northwest Community College Mobile Unit (interior)

3. Pilot Projects

In spring 2017, ITA launched six innovation pilot programs across the province to address apprentice and employer challenges associated with block-release training, and one pilot program for pre-apprentices focused on providing work readiness supports. The pilot projects were developed out of a demand from apprentices facing barriers to program completion and employers facing challenges finding apprentices who had some work experience and were familiar with workplace expectations.

Innovation Pilot Participants:

Training Provider	Apprenticeship Program	Number of Students
Camosun College	Pipe Trades* (Level 1)	10 students
Camosun College	Professional Cook (Level 3)	8 students
Okanagan College	Electrician (Level 1)	7 students
Vancouver Community College	Automotive Glass Technician (Level 1)	6 students
Vancouver Island University	Baker (Level 1)	12 students
North Island College (NIC)	Foundation Programs: Electrician, Heavy Equipment Operator, Welder, Aircraft Structural Technician and Carpenter	75 students

*Pipe trades include: Plumber, Steamfitter/Pipefitter, Sprinkler System Installer and Gasfitter.

Online/Blended Training Pilots

"I am sincerely impressed with this online course. The interface is very simple and intuitive, and the content is accurate as well as comprehensive. The quizzes are fair, but challenging. I really like how there is information and testing on elements and tools technicians may run into if working in auto centres."
– Student testimonial, Automotive Glass Technician

The online/blended training pilots were aimed at increasing flexibility for those individuals with busy schedules, long commutes, or who may otherwise be unable to devote a longer period of time to on-campus learning. The pilots were also developed to ease employer challenges associated with having apprentices away from the workplace for weeks at a time for offsite technical training. Knowing this, the pilots were designed to resolve or lessen these barriers, while improving outcomes.

Goal & Objective:

The pilots were developed by subject-matter experts and training providers across the province, who had the same goal in mind: to provide flexible learning and regional access to trades training for apprentices. The objective of the pilots was to test alternative training delivery systems for today's contemporary apprentice learners to improve outcomes and introduce options beyond block-release training systems.

Outcomes:

"Using current and up-to-date technology for online delivery offers the ability to bring professional education to the workplace on an on-demand basis. Program content can easily and quickly be adapted to the needs of industry."
-Gilbert Noussitou, Chef Program Developer and Instructor/Coach, Professional Cook Level 3

Each program focused on providing quality training, using a blended approach to delivery to reduce barriers to completing training. Using digital learning processes and technologies, the flexible blended model used in the pilot programs maintained the quality and rigour of traditional training delivery models, while also reducing the amount of time an apprentice is away from the workplace, home and family. Although the initial idea behind the pilots was to target those students who live in remote areas or have economic barriers that prevent taking in-person programs, upon program execution the discovery was that these programs are appropriate and helpful to students in many different situations.

"The program Vancouver Community College (VCC) has put together is now head and shoulders above the one I attended about ten years ago. I think this new standard will impress everyone in the industry and help create a culture of quality and know-how that we've been craving."
– Student testimonial, Automotive Glass Technician

While some pilots are still ongoing, common challenges have been experienced and key learnings uncovered.

Challenges & Key Learnings:

- Recruiting apprentices to the pilot programs was the greatest challenge experienced collectively by all program facilitators. There was a very short timeframe between the beginning of recruitment and the actual start date of the programs, which didn't allow apprentices much time to research the program or alter their schedule. For future programs, training providers should start the recruitment process as early as possible to allow prospective apprentices the ability to plan their schedules accordingly. Based on enrollment, retention and completion rates, training providers indicated that additional up-front information about the time requirements, structure and technology used for on-

line portions of training needs to be incorporated into recruitment and selection processes. Some suggested a tutorial for participants or some assessment to determine technical abilities of applicants as a screening tool.

- Program development costs were underestimated for the development of quality online materials that met the same standards found in the traditional (face-to-face in-class) programs.
- *Auto Glass Technician Apprentice Pilot* - Industry is hesitant/unfamiliar with new modes of delivery (i.e., online/blended). Additionally, using a blended model results in less flexibility because online content is fixed, whereas the traditional face-to-face model allows for valuable impromptu and ad hoc discussions with instructors. Only three of eight participants successfully completed online and face-to-face training.
- *Baker Apprentice Pilot* - Finding good candidates who have the skills to succeed in an online program can be challenging. Students need to be self-disciplined, independent workers, with sufficient digital literacy skills to be able to use the technology and software successfully. Eight of twelve students completed this unique, 100% online course. As with several other pilot programs, there is a suggestion to utilize a computer literacy test to screen applicants and possibly to incorporate an applicant interview to help determine suitability for online learning by assessing other responsibilities and issues learners have (e.g. family, work, health, etc.) Learning outcomes were excellent, and the online course was described as "separate but equal" in quality to the traditional face-to-face delivery model.
- *Electrician Apprentice Pilot* - First-year apprentices may not be as eager to engage in online learning as was anticipated. Future programs may wish to begin with second, third or fourth year apprentices who have already experienced being a student at the college and may wish to try something more flexible.
- *Pipe Trades Apprentice Pilot* - Creating conditions so that all learners are working together as a cohort to contribute to engaged discussions within the online discussion forum is challenging. Creating and facilitating student collaboration in an online format can take time to establish. Seven of ten apprentices enrolled successfully completed their training. Average final mark was 86%, indicating that online tools and methodology were as successful in teaching required content as traditional face-to-face delivery.
- *Professional Cook Apprentice Pilot* - The development of effective, best-in-class online instruction and assessment materials and learning resources is time-consuming, and adequate time needs to be dedicated to produce quality, media-rich materials.

4. From Trades Training to Work Experience: A Pathway to Career Advancement Pilot

"I have never had an opportunity to access this level of information before. This is invaluable."
– Student testimonial

In the northern region of Vancouver Island, feedback was received from local employers that additional support and insight into employer expectations, workplace readiness and industry engagement through a formalized and structured work experience program module was needed. In response to this demand, North Island College (NIC) developed an innovative foundation (pre-apprenticeship) program that focused on the integration of employability skills, workplace mentorship and a formal work experience program module. This program, currently in its first year, has been developed through consultation with industry and students. This initiative brings significant benefits to students as they transition to the workplace. The skills students learn in this unique program are anticipated to have a direct impact on retention and succession of student learning through to apprenticeship training.

Goal & Objectives:

The goal of the NIC innovation pilot is to advance programming by removing barriers to employment for students as they transition from the NIC Foundation programs into careers. The project includes the integration of employability skills, workplace mentorship and formal work experience. The objectives of this pilot program are to enhance student transition to meaningful employment upon completion of foundation programming, increase industry engagement and support for new entrants into the workplace, establish a trades-based mentorship model, provide job readiness training specifically informed by and based on industry expectation and requirements, and enhance access to applied job search skills and support services as students market themselves and their skills to employers as they pursue work experience.

Outcome:

"I feel better prepared – I now know how to research employer expectations, how to prepare for the interview and how to be the best team member possible."
– Student testimonial

This pilot program has been successful in terms of student, industry and employer engagement and participation. Industry involvement continues to expand as the program grows and evolves. Student participation, which is optional, has exceeded the program enrollment target with 75 students enrolled in the program to-date. The ongoing challenge as the program grows is to ensure curriculum development and refinement reflects industry needs, work experience is formalized and comprehensive consultation with students, industry and employers remains a priority.

Employers who brought participants onto their work sites for a one-week work experience placement were unanimous in their support for the program based on the preparation and attitudes of students. All indicated their willingness to provide future work placements for the course. A few of the employers have indicated that if entry-level job opportunities arise in their firms that they would be interested in hiring students who completed their work placements with them.

5. Pacific Vocational College & Pitt Meadows Plumbing: Employer-Supported Training Pilot

Training Provider	Apprenticeship Program	Number of Students
Pacific Vocational College	Plumbing Level 1	20 students

"This exciting and innovative program is the first of its kind for the piping trades and we are excited to be a part of this project and to see where this opportunity will take our apprentices. We are the wave of the future and many eyes are on us."
-Robert Bradbury, president, Pacific Vocational College

Pacific Vocational College (PVC) became aware that barriers such as distance to training providers and access to online learning and technical training were affecting plumbing apprentice outcomes and employability in the Lower Mainland and Southern Interior regions of BC. In order to tackle this challenge head on, PVC partnered with Pitt Meadows Plumbing to develop a first-of-its-kind, innovative employer-supported training program to enhance plumbing apprentices' experience and to improve outcomes.

Goal & Objective:

PVC's goal was to develop a leading-edge program that would blend traditional teaching models into a real-life learning environment. By partnering with Pitt Meadows Plumbing, apprentices were able get their technical and practical training in one location. The apprentices attended on-site classroom instruction in the morning and then got their hands-on experience in the shop in the afternoon. The objective of this partnership was to save students travel time between the classroom and on-site practical training, expose them to best-in-class learning technologies and to familiarize them with the equipment they can expect to use on future projects.

Outcomes:

"As an employer, we are fully supporting Pacific Vocational College in enabling apprentices to receive exceptional hands-on technical training at an accelerated rate. Participants are encouraged to grow in their practical knowledge on multiple job sites, supported by the

knowledge of industry leaders through and after completion of the program. We are confident this partnership project will foster further support from industry decision-makers and cultivate company loyalty from valued program graduates."
- Steve Robinson, president, Pitt Meadows Plumbing

The program consisted of two intakes of Level 1 technical training for up to 20 plumbing apprentices using PVC's eLearning portal. Each apprentice was provided with a tablet computer that was pre-loaded with the plumbing Level 1 course materials. Apprentices worked from their tablet and instructors were able to review students' work in real time and provide immediate feedback.

By delivering the training at Pitt Meadows Plumbing, apprentices were able to directly apply what they learned in the classroom to the equipment and projects that were in progress in the shop. Pitt Meadows Plumbing also leveraged the use of technology, such as Virtual Reality, so apprentices and journeypeople could work on pre-fabrication projects without having to be at the worksite or refer to drawings and schematic files.

A key takeaway from the success of this pilot was that employer-supported training diminishes the issue of waiting for seat availability at a training provider and sharply reduces the time apprentices need to be away from the workplace to get their in-classroom instruction. This partnership is also a great way to build loyalty within the company, as Pitt Meadows Plumbing took on a proactive approach to ensure that their apprentices are advancing through the apprenticeship journey to certification.

Next Steps

Innovation in trades training is an important step not just for BC, but for all of Canada. The measures we're taking now will ensure more efficient, responsive skills training and a stronger skilled trades system for the future—one that fully engages modern-day apprentices and tradespeople from start to finish. Our dedication and commitment to developing innovative trades training solutions will help attract, train and retain apprentices and tradespeople in such a way that will ensure our province has the right skills, in the right place, at the right time. Such enhancements to our trades system will not only ensure we meet the economic demands of the future, but will also enable British Columbians to take advantage of job opportunities today and tomorrow.

We know that apprentices face various challenges to completing their certification, and these require innovative and collaborative solutions. We also know that employer sponsors need support in helping apprentices complete their certification that considers both the demands of their businesses and the resources available to them. ITA will continue to explore innovation in

trades training, with the goal of uncovering innovative solutions to successfully engage the next generation of skilled tradespeople.

Skilled trades are a key component of our economy and encompass some of the most in-demand career opportunities. With this in mind, it is critical that we continue to foster a culture of collaboration and innovation in order to meet BC's labour market demand with skilled tradespeople across the province.

For more information about the Industry Training Authority, visit itabc.ca. Find more detailed information about innovation in the skilled trades in BC here, itabc.ca/innovation-trades.

About the Author

Gary Herman, Industry Training Authority (BC)

Gary is the Chief Executive Officer of the Industry Training Authority (ITA), responsible for the governance, expansion and improvement of BC's industry training system. After joining the organization as Chief Operating Officer in January 2013, he was appointed interim CEO in August the same year, then permanent CEO in August 2014. Prior to the ITA, Gary served in executive management positions at ThyssenKrupp Fabco, VAE Nortrak and Ebco Industries. Gary began his career by apprenticing for seven years in three trades and is certified as a Tool & Die Maker and as a Die Sinker (forging). He is also a Certified Manufacturing Engineer and has a Business Administration Diploma and an Executive MBA. In addition, he has recently completed a Directors Education Program through the Institute of Corporate Directors and received his ICD.D designation.

Virtual Reality and Co-operative Trades – The Next Generation

Doris J. MacKinnon, Red Deer College

"This is going to be awesome."
"Thank you for the training."
"I'm really enjoying the program."

These are the words of some of the respondents to a survey question as our welder technical training program began. They are the responses that we certainly hoped we would receive when we were designing this program. We just did not think that we would hear the comments so early in the training.

Background

From the beginning of the interview process through to the technical training and on-campus experience, our students are voicing both their appreciation for and their pride in being chosen as the first to participate in this innovative training, made possible through the federally funded *Flexibility and Innovation in Apprenticeship Technical Training* (FIATT) pilot.

The primary goal of our FIATT program was to be innovative, not only in our training schedule, but also with the tools that we used for the technical training. In the traditional welder apprenticeship program in Alberta, an apprentice first finds an employer who is willing to indenture them with Apprenticeship and Industry Training. That apprentice then completes 1,560 hours of training in the workplace, followed by attendance on campus for technical training. This block training schedule continues until the apprentice has accumulated the required hours of technical training and on-the-job training in order to write the certification exam.

The traditional apprenticeship model in Alberta means that apprentices may have difficulty finding that first job placement. This model can also present challenges for completion rates, as both apprentices and employers may at times become frustrated with the training schedule. Employers may find more value in a training model that allows them to work with new apprentices who already present with some technical training.[1]

[1] A report conducted for Statistics Canada in 2005 noted that "Half of the 29,501 persons newly registered in an apprenticeship program in 1995 completed their program at the end of the 11-year study period, in 2005" (Louise Desjardins, Statistics Canada, Minister of Industry, *Completion and Discontinuation Rates of Registered Apprentices: Does Program Duration Matter?*). In a more recent report for industry by the University of Calgary's Haskayne School of Business, it was noted that the number of heavy trades apprentices who registered and actually achieved journeyman status between 1991 and 2012 was listed at below 20% *(*Scott Rankin and Brenda Nguyen, *Supply Bottlenecks and Barriers: Trades Apprentices - Report for the Oil Sands Multi-Stakeholder*

Training Model

In our pilot program, which has the initial support of Apprenticeship and Industry Training, we have adjusted the training model, while also incorporating some new and "awesome" technical training tools. We have also tailored some of our training program to accommodate Indigenous learning models. Our students begin their technical training as a cohort in their own First Nation community, where they complete the safety training and begin to learn the trade by using augmented reality welding simulators. This training schedule means that our students complete their upgrading and safety training before ever stepping foot on a shop floor. It also means that our students practice as much as necessary in simulated welding environments with minimal risk and minimal use of consumables until they are more familiar with their trade.

Our students then attend on-campus training as a cohort for another ten weeks of technical instruction in our welding labs. In the first period of this on-campus training, our instructors already note advanced skills when compared to students in a pre-employment training program. We anticipate that this accelerated learning will continue through the paid co-op work placements that we are incorporating into our pilot program and, in fact, initial feedback from some employers has confirmed this to be the case.

While co-op job placements have not traditionally been implemented in pre-apprenticeship training programs, these types of targeted work placements have resulted in very high completion rates in professions such as engineering and accounting. It is our belief that we can rely on two separate and distinct co-op work placements for each of our welding students as a way to improve completion rates and employment success, when compared to welding students in a traditional training program. These are particular challenges for under-represented groups in the trades, such as Indigenous people.

Working Forum, May 2013, data retrieved from "Registered apprenticeship training, registrations, by age groups, sex and major trade groups, annual (Number), 1991 to 2012").

Nature of Innovation

Innovation by its very nature presents challenges and risks. In his book *The Ten Myths of Innovation,* Scott Burken notes that, while most *say* that their goal is to be innovative, we are actually a conservative species who, in reality, do not love new ideas. Most tend to want to do things the same way that they have long been done. Another of Burken's myths is that innovation is always good.[2] This suggests that any new program should be mindful that some things are best done the way that we are currently doing them and that, even if some things should be done differently, there is likely to be some measure of resistance to change.

Our program has encountered some resistance, to be sure. Indenturing our students as welding apprentices can only occur after they find employment. We continue to work with Apprenticeship and Industry Training and our Provincial Advisory Committee to obtain permission to develop alternative testing methods to accommodate for cultural differences. In the case of industry, some of the resistance we have encountered stems from the fact that, when this project was conceived, the economy in Alberta was stable and we anticipated that the task of finding job placements would present only a minor challenge. However, by the time the process of evaluation and approval by the funder was complete, the Alberta economy had been adversely affected by the sharp drop in world oil prices. Thus, any resistance from industry as we worked to identify those job placements was motivated more by the economy than by a concern about the training model that our project involves. In fact, provincial industry representatives have been very receptive to our innovative training model.

Partnerships

Despite the challenges in the economy, our partner WorleyParsonsCord (in addition to providing financial commitments to our program), has worked diligently to assist us with work placements for our students. As our program has progressed, other employers emerged as new partners to provide work placements for a number of our students.

The mandate of this program was to propose a training model that would address the needs of under-represented groups in the trades, and our target group was First Nation communities within our service area. Montana First Nation community leaders and members fully embraced our program from its inception. They provided invaluable support in terms of community facilities, cultural guidance, student recruitment and mentorship, fundraising, transportation and income supports.

Because of the leadership demonstrated by Montana First Nation, our student recruitment expanded to the four nations of Maskwacis, Alberta, which includes Montana First Nation, Louis

[2] Scott Burken, *The Ten Myths of Innovation,* California: O'Reilly Media Inc., 2010.

Bull Tribe, Samson Cree Nation and Ermineskin Cree Nation. Interest in the training model was so high that many qualified candidates had to be turned away.

Reality

The reality of life in many Indigenous communities in Canada is that residents live in chronic poverty. This means that many do not have access to transportation, internet and other very basic resources that so many in Canada not only take for granted, but that are so necessary to obtain long-term, meaningful employment.

Our program took these realities into consideration from the conceptual stage and supports such as travel, student services and practical tools for success were included. However, even with these supports in place, we expected that there might be some hesitance from participants to attend the on-campus training component, where only a small percentage of our student body is Indigenous. However, the students in our pilot have embraced the learning and the campus experience, with a high number of them passing their first practical exam. There were more challenges with the mandated standardized testing of technical theory, in many cases due to knowledge translation systems and cultural differences between western and Indigenous communities. Where possible, we are accommodating for these challenges in order to give every student an equal opportunity to achieve their goal. While there were many components of the curriculum that could not be changed due to industry regulations, where possible, the programming infused cultural teachings and learnings from elders with technical and hands-on training.

Telling the Story

Given our current student population, we also wanted to incorporate innovative tools in our FIATT pilot that would assist us in understanding the experience for our students through all stages of the training. Working with our First Nation partner and the Canadian Apprenticeship Forum, we will incorporate knowledge-sharing circles as a way to allow participants to share their challenges and successes in the learning journey.

Guided by our internal research ethics committee, we are also incorporating a PhotoVoice project as a way to provide further opportunity for our learners to reflect upon and to share their experiences. Students who wish to participate in this way are provided with cameras that allow them to record their experiences. They then share the narrative of their experiences with our internal Student Ambassador Assistant. The narratives gathered will allow us to understand the experiences of learners in our FIATT project from their own perspectives as we seek to enrich the experiences of an increasingly diverse student body.

Evaluating Success

When we move to the evaluation stage for this program, we are mindful of the different measurements of success depending on life circumstances. While it is certainly the desired outcome that all of our students will achieve journeyperson status, it may be that success at any stage of the training is a milestone for some learners that never would have been possible without this program. As Montana First Nation counsellor Brad Rabbit notes, Indigenous students "face many obstacles to getting an education, including cultural barriers. It's far less intimidating to start the program on familiar ground." He continues that this new program has already had a positive impact on the mood in the community and "when you see achievements of some of these students, the morale builds. The self-esteem builds. When you can build that positive energy, positive things will happen." Given that there were 300 applicants from the four nations of Maskwacis, Alberta, for only 50 available spaces in our program, we tend to agree that positive things are happening.

Successful applicants to our program were placed into two intakes of 25 students and then studied as cohorts of 12 or 13 students. We staggered the start dates, as we believed that this, combined with the smaller cohorts, would assist us to make adjustments based on first intake results. We also felt that the smaller cohorts would better support student success as they formed their own learning networks. At the end of the first period of technical training on campus, 41 students were prepared for work placements. While a significant percentage (90%) of these students passed their welding practical exams, a much lower percentage (40%) passed their industry theory exams, which consist solely of multiple-choice questions. For many Indigenous students whose family support networks have little experience with post-secondary education,

and where English might be a second language, it can be difficult to make sense of the written word, particularly in multiple-choice exam situations.

We have not yet come to an agreement with our provincial industry training regulator with regard to alternative evaluation methods for those students who, often for cultural reasons, struggle with the mandatory multiple-choice theory exams in the certification process. However, as a way to work towards different measures of success, we have committed to developing alternative exams which will incorporate short written and oral answers. For those students who are not successful in the industry exams, they still have the opportunity to complete all of the technical training and to graduate from our college with a career development certificate. Another option for our students is to obtain Canadian Welding Bureau (CWB) tickets, and then to pursue employment opportunities with employers requiring this certification. Even for those who do not ever achieve journeyperson certification, we have no doubt that the skills they have learned in this pilot project will present unlimited possibilities that they did not have before.

When we evaluate the success of our project, we are also mindful of the social aspect of that success for each of the students in our pilot project. Our First Nation partner organized a Year 1 Completion Ceremony for all successful students. Throughout the program, students received attendance awards and took part in team-building and professional development activities.

Some of the comments that students made to our student researcher during our PhotoVoice project were very telling about the positive results of being chosen to participate.

For Morningstar, the sentiment is best expressed with a photo of her first time through the campus doors:

> *This one, I like walking through the doors of the college for the first time. And just like, cause I didn't think that I was ever gonna be in college. I was so happy I just about cried. I was happy, excited, scared. It was different. Kind of overwhelming. But I was really excited though. Happy that I'm, that I have this opportunity…I want to make a better life for myself and not have to ask people for help anymore.*

For Chris, his acceptance into the FIATT project is about moving forward:

> *Each picture represents something as to why I took it. I adore each one, this one here really gets me cause it's on the north, so you focus on say the four directions if you go north you're just moving forward, that's what I like about this picture…I love it. I just can't wait to weld.*

For Chantelle, there is a pride of ownership in her campus workspace:

> *This one here is with my booth as you walk in. I took it because it's like my station I walk into. I'm really grateful that I got this opportunity because I'm welding. I'm gonna be the first welder in my family…I thought it was awesome to take this photo here. We have my*

teacher Tom and Chad, he's hearing impaired, and the interpreter, they stand there in the corner for anybody who needs to communicate or if he needs to communicate with anybody and it just goes to show that being deaf is not a barrier to welding…you want to open up to other people and here is where if you ask for help they won't hesitate to help you or anything…I'm really grateful for this opportunity, I just, there's days here and there but honestly, I just love coming, learning, I can't wait to get out and work. That's what I want to do I want to start working.

We are aware that the students in this project view themselves as role models for their communities, and are integral members of the partnerships that the FIATT project enabled. As Mr. Rabbit observes of the partnership between the Government of Canada, Montana First Nation, Red Deer College and WorleyParsonsCord:

Creating these partnerships is key in ensuring that we are able to meet the demand and needs of the community. We feel that First Nations are a very important component to the labour force, not only in Alberta but Canada as a whole.

Student and community feedback such as this suggests that participation in our FIATT project has been transformational for our students. We agree with our community partners and with our students on all counts – this program is awesome!

About the Author

Doris J. MacKinnon, Red Deer College

Doris works as an instructor and program coordinator at Red Deer College. She has published articles and books on education and history, with her latest book due for release in November 2017 by University of Alberta Press. Doris has a Ph.D. in Canadian and Indigenous history from the University of Calgary.

Saskatchewan Polytechnic FIATT Project

Dalton Mervold, Saskatchewan Polytechnic

Introduction

Across Canada everyone involved in the apprenticeship system is looking for better ways to prepare our workers for the changing requirements in every trade area. With the changes to regulations, trade code books, technology and a rapidly aging workforce, the challenges to provide meaningful, authentic training that is flexible and suitable for all involved is becoming a very difficult process.

Employers do not have extra employees that can fill in while apprentices are away for extended periods of time to take their technical training at institutions that might be away from the apprentice's home community. There is a real cost of leaving the workforce to attend training that affects employers, apprentices, family members, as well as their community. The cost of living away from home to attend technical training is also a factor, and with the compulsory trades it is not an option if you want to continue to work in the trade area.

The trend over the years has remained the same. Every year, the apprentice must leave work from 6 to 9 weeks to attend technical training and this will continue for 3 or 4 years until they have enough time in the trade and technical training to challenge the Red Seal Journeyperson exam.

In 2015, the Government of Canada offered a grant to training providers to develop new initiatives that would benefit apprentices by either shortening their on-campus training time, eliminate the need to relocate for training or provide alternative methods to deliver the training.

Saskatchewan Polytechnic working with the Saskatchewan Apprenticeship and Trade Certification Commission (SATCC) applied for the *Flexibility and Innovation in Apprenticeship Technical Training* (FIATT) funding to address some of the barriers that apprentices were facing in Saskatchewan. The proposal would shorten the amount of time that apprentices in four trade areas would have to be on campus for their technical training. The proposal was to have apprentices do one or two weeks of theory online prior to attending the on-campus training. This would shorten their on-campus time and also allow them extra time and resources to cover some of the more difficult theory concepts that they would be learning during the level of training.

The Plan

The project was approved in September 2015 and will be completed by the end of March 2018. The objectives of the project were to deliver online training to several apprentice groups from four specific trade areas. Using a systematic approach, the tasks were outlined for each of the three years of the project.

During the first year of the project, theory courses were chosen from the following four trade areas.

1. Construction Electrician
2. Heavy Duty Equipment Mechanic
3. Plumber
4. Truck and Transport Technician

These four trade areas are all higher demand trades in Saskatchewan. Reducing the time away from work would benefit everyone involved. If this pilot project is successful and continued after the pilot is completed, it might allow for more groups of apprentices to attend technical training as it would free up time in the already extremely busy technical training facilities.

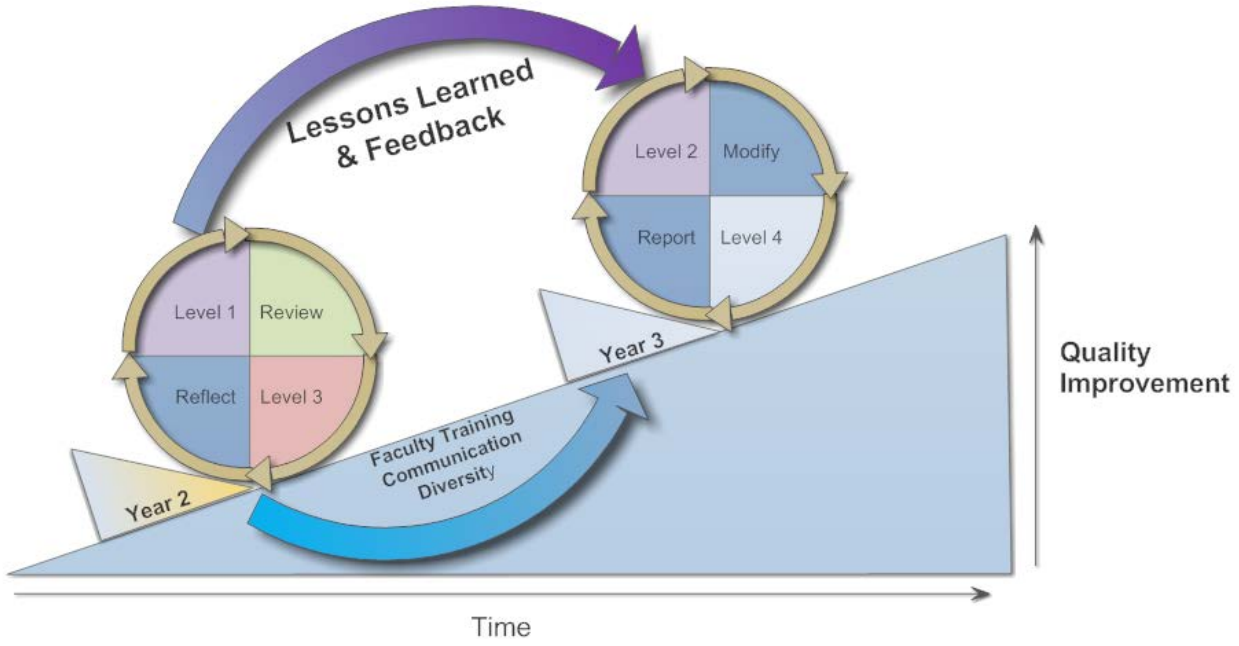
Meetings with the SATCC were held to decide on the best timing and how they would select the apprentices that would be participating in the pilot. It was an extreme amount of effort and work for SATCC to contact every apprentice that had signed up for those four trade areas but had not yet started on-campus technical training. The SATCC also sent out letters to each apprentice that was waiting to start Level 1 and Level 3 in the 2016-17 Academic year.

Included in the marketing and recruitment plan, either a field consultant from SATCC or Sask. Polytechnic faculty visited the Level 2 apprentices to see who would be willing to sign up for the pilot for Level 3. The goal was to have a wide range of apprentices in the pilot so we could see how the online courses worked for apprentices with and without disabilities. To get a wide range of apprentices from equity groups, we offered the opportunity to every apprentice taking either Level 1 or 3 to apply to be part of the pilot group. Due to our policies, the only way to know if an apprentice was from an underrepresented group or had a disability was if they self declared.

There were some apprentices that informed us that they did have learning disabilities and that having online content for the extended period of time was better for them. We are still tracking the number of apprentices with disabilities and, in the coming year, we add questions to our surveys that ask them if and how the pilot removed any barriers.

Polytechnic faculty from the pilot programs worked with instructional designers to build online content that would be engaging and highly interactive for the apprentice. This was done to make the courses interesting and interactive, plus address any apprentice learning disabilities.

The illustration below shows the systematic approach that was used and how best practises and feedback from all groups involved could improve the content and delivery for the final year of the project.



Design

The apprentices in the pilot started their online training the beginning of October and would have until the first week of January to complete it prior to coming to the on-campus portion of their training. This cycle was completed in the 2016-17 academic year and will repeat for the 2017-18 academic year.

This project was designed to have interactions in four ways.

1. Interaction between the course content and the Apprentice

2. Interaction between the Instructor and the Apprentice
3. Interaction between the Apprentices
4. Interaction between the Apprentice and either their Employer or supervising Journeyperson

The course content had self-assessments and opportunities to interact with the content throughout the courses. The courses were designed to be media rich and, after each illustration or video, there are activities that engage the apprentice with the new materials they had just covered.

Every instructor called every apprentice to get started on the pilot. They also connected by phone at least once a month during the online portion of the training. The instructors asked the apprentices when the best time to call would be and then set up a schedule so that they could discuss the materials as well as provide any assistance the apprentice needed. Other methods of communications were also used, such as texting, Skype calls and email. This created sense of community and encouraged apprentices to become engaged in the pilot.

Each course was designed to require discussions between the apprentices around things they had learned in the workplace or the course materials. This was done to simulate the conversations that would happen in a classroom setting. This was identified as one of the interactions that was less successful than we forecasted. Most apprentices indicated in the survey that they had minimal interaction with the other apprentices in their group while completing the online training.

The last type of interaction that took place, which is probably the most rarely used during technical training, was the interaction between the apprentice and their employer or supervising journeyperson. This was done by having questions about the trade built into the course that the apprentice would have to go to their employer to answer. To make this interaction as meaningful as possible, the apprentice would post their findings in a discussion post accessible to other apprentices in the group and the instructor so others could learn from their experience. This sharing of information was built into the courses and posting the results was done by both levels of apprentices in all four trade areas.

Both the Canadian Apprenticeship Forum and Sask. Polytechnic surveyed and interviewed employers as part of the pilot. Additional interviews and surveys targeting a larger group will be done after the final group of apprentices complete the pilot.

Initial Results

The first group of 88 apprentices in the pilot completed their training in each trade area by the end of February 2017. Surveys were done by the Canadian Apprenticeship Forum before and after each apprentice attended on-campus training. Saskatchewan Polytechnic also did surveys

of both apprentices and faculty that have been involved in the pilot so far. The survey results listed in this report are from the Saskatchewan Polytechnic survey that was conducted using an online survey tool. The survey completion was voluntary and only 62 of the 88 apprentices in the project completed the surveys. Figure 1 provides survey results. The survey indicates that, overall, most students had a positive experience with the online portion of the training. For example, a majority of survey respondents strongly agreed/agreed the online content was:

- Engaging (53.3%)
- Relevant to their work (64.5%)
- Self-evaluation tools were relevant (71.0%) and useful (66.1%)
- Graphics, pictures and other interactive tools enhanced the learning experience (67.7%)

Figure 1 - Experience with online training

	Strongly Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree	Total Responses
The online training was engaging	4 (6.5%)	29 (46.8%)	9 (14.5%)	13 (21.0%)	7 (11.3%)	62
The online content was relevant to your work-life	8 (12.9%)	32 (51.6%)	17 (27.4%)	3 (4.8%)	2 (3.2%)	62
In the online training, you were encouraged to explore new topics	11 (17.7%)	21 (33.9%)	17 (27.4%)	10 (16.1%)	3 (4.8%)	62
Self-evaluation tools such as quizzes were relevant	14 (22.6%)	30 (48.4%)	2 (3.2%)	11 (17.7%)	5 (8.1%)	62
Self-evaluation tools such as quizzes were useful	14 (22.6%)	27 (43.5%)	6 (9.7%)	12 (19.4%)	3 (4.8%)	62
It was important for you to do well on tests/quizzes	27 (43.5%)	21 (33.9%)	6 (9.7%)	5 (8.1%)	3 (4.8%)	62
The graphics, pictures and other interactives used in the course added to your learning experience	16 (25.8%)	26 (41.9%)	11 (17.7%)	6 (9.7%)	3 (4.8%)	62
It was easy to contact your instructor	39 (62.9%)	15 (24.2%)	5 (8.1%)	3 (4.8%)	0 (0.0%)	62
You had meaningful interactions with your instructor(s)	27 (43.5%)	20 (32.3%)	13 (21.0%)	1 (1.6%)	1 (1.6%)	62
More interactions with the instructor(s) would have been helpful	11 (17.7%)	20 (32.3%)	27 (43.5%)	2 (3.2%)	2 (3.2%)	62

	Strongly Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree	Total Responses
It was important for you to get to know other students in the online training	2 (3.2%)	9 (14.5%)	22 (35.5%)	16 (25.8%)	13 (21.0%)	62
You were given opportunities to get to know other students in the online training	1 (1.6%)	11 (17.7%)	19 (30.6%)	14 (22.6%)	17 (27.4%)	62
You had meaningful interactions with other students	1 (1.6%)	6 (9.7%)	15 (24.2%)	17 (27.4%)	23 (37.1%)	62
More interactions with other students would have been helpful	7 (11.3%)	19 (30.6%)	21 (33.9%)	4 (6.5%)	11 (17.7%)	62
Your employer supported you during online training	14 (22.6%)	14 (22.6%)	21 (33.9%)	5 (8.1%)	8 (12.9%)	62

A number of apprentices from both Levels 1 and 3 indicated that online studies took time away from family, and that working all day before doing school work in the evening and on weekends did not work well for them. There were also some general comments that they would like to see more videos and links to things like YouTube in the online content.

There were a number of positive comments written by the apprentices in the surveys.

Level 1 comments:

- A lot of the math and calculations that I learned online I have already started using at work.
- I knew more extensively what I was doing while working on a job, instead of just being given a task and doing it, I actually knew how things were working.
- It also reduced the lost wages for 2 additional weeks.
- Overall most of the information was new to me, and can be applied to my day to day work.
- The pipe calculations and some of the math I was able to apply to what I was doing at work at the time.
- I'm a slow learner, need more time when learning on it.
- Helped me with my safety behaviour.
- The online portion was very flexible and could work on it at my own pace.
- The videos added online as they were very helpful.

- I found value in learning the materials before coming to class. It definitely prepared me for the course.

Level 3 comments:

- I have a family at home and eight weeks is a long time to be away.
- The six-week timeframe just seemed so much more manageable.
- I liked that we could work at our own pace.
- It saved me money and time.
- I was able to spend extra time on material that I found more difficult and spend less time on topics that I had less difficulty with.
- If they going to ask me to take the 4th year online FIATT cours,e I will enroll in it again.
- Offer more online training to cut down on in school time. The in-school time is definitely important, however, it is inconvenient and more online training should be offered.
- The information I learnt online helped me understand things I was doing at work more clearly.

Feedback was also gathered from instructors in the project. The feedback was gathered by both the online surveys and interviews with each instructor. There were five instructors that were assigned to the actual teaching and monitoring of the apprentices. The comments gathered from the instructors were surprisingly similar between the trade areas and the levels of apprenticeship.

Instructors also provided some positive comments from the surveys:

- It didn't take long for me to realize that I was forging a stronger connection with these "online" students than I ever would with a group of face-to-face students.
- This extra connection with the online students thrilled me as I realized that students who are well connected with instructors excel in the classroom. Also, instructors who are well-connected with students enjoy and perform their job better!
- We got off to a great start during the block training because we already "knew" each other.
- Overall, it was great experience and it is my hope that we expand and continue with online learning for apprentices.
- With communications as they are today, students had almost instantaneous access to me for help and I could deliver the help in a "real-time" fashion.

The SATCC has completed a preliminary review of the actual results between FIATT apprentices in these four trades and apprentices who attended the regular block training in 2016-17. The results are encouraging. The pass rate of FIATT students was slightly higher in most cases than those in block training and FIATT students discontinued training at a lower rate.

Additionally, apprentice grades within the course modules covered in FIATT courses were, on average, equal to apprentices who completed these modules in regular block training. Similarly, apprentices in FIATT classes had equal, or slightly higher, overall averages within the courses when compared to apprentices who attended regular block training. It should be noted that any differences between the FIATT courses and the regular block training are not likely to be statistically significant because of small differences in results and the small sample size.

Therefore, the preliminary results suggest that apprentices are likely to do equally well in the FIATT training as they would in regular block training. This may help ease the reluctance of some apprentices to participate in FIATT-style training, particularly for higher-level apprentices, noted in the next section.

Barriers/Challenges

Despite the positive results listed earlier, there were also a number of barriers or challenges that arose. Some of these were addressed in the pilot, while others will continue to present challenges going forward.

An initial barrier faced was to get apprentices in these trades to voluntarily join the FIATT classes. This was a challenge because face-to-face block training is the traditional training format familiar to apprentices and their employers. Anecdotally, the SATCC found many apprentices were reluctant to participate in the FIATT pilot because it was unknown to them and many feared using an online format. In Saskatchewan, apprentices cannot self-register for technical training. It took significant effort on the part of the SATCC's staff to fill the FIATT pilot classes. This level of effort would simply not be feasible on a system-wide basis across all the trades unless all courses had an online component.

Another barrier for Sask. Polytechnic faculty was the change in style of delivery required from their regular methods. The faculty that joined the pilot had an enormous learning curve, both in learning to design materials to be used in an online course and then to learn how to teach to online students. Using our learning technologies faculty trainers, instructors attended weekly online training sessions where they could experience the online setting and get comfortable working in that environment.

There were also a number of challenges identified within the survey results:

- There was a stark distinction in the survey results between Level 1 and Level 3 apprentices. Specifically, most Level 1 apprentices were very strongly positive in their experience with the online content while Level 3 apprentices were more negative to neutral in their assessment. It is speculated that Level 1 apprentices "don't know what they don't know" because they had most likely never before attended technical training, while Level 3 apprentices had likely attended one to two levels of regular block training.

As such, Level 3 apprentices were less accepting of the FIATT course format. The SATCC anticipates it will have a more challenging time filling the Level 4 classes in year three of the project.

- A majority of respondents felt that employers did not adequately support them during the online portion of training. This may increase resistance from apprentices to taking classes in the FIATT pilot or permanent classes offered in this format.

Since the apprentices worked during the day the faculty had to come up with ways to communicate with them during breaks, after hours and even on the weekends. The surveys revealed that 85% of the apprentices preferred to be contacted in the evening or weekends. Also 76% of the apprentices reported that this was their first online course. Both of these factors could have created barriers for the faculty and the apprentice.

Conclusion

The first phase of the pilot in preparing the course materials and training the faculty was successfully completed on time. The second phase, where we did the online training and then the reduced time on campus, was also a success. The Saskatchewan Polytechnic survey results, as well as the qualitative and quantitative data we have gathered so far, confirms that the overall grades of the pilot apprentices are slightly higher than those of non-pilot apprentices. Quantitative data was gathered in the form of completion grades of both pilot and non-pilot apprentices in the same trades and levels. Qualitative data was gathered from surveys, discussions and interviews with program instructors. Comments from the pilot apprentices and instructors were positive, indicating they felt included in the group and the learning process.

Apprentices with disabilities also commented that having access to the course materials for three months prior to coming to on-campus training gave them time to go over the content and get whatever support they needed to be successful learning the content. They continued to have access to this content during the on-campus training period.

Another positive development has been that an instructor is using the online courses with an on-campus group of apprentices, giving them access to the materials and media during their technical training period, in the evenings and on weekends. The use of media to enrich the learning environment is critical for apprentices during their online studies and while in school to refer back. The ability to share this media enhancement with all apprentices in the future will be a benefit to traditional groups as well.

Looking back at the progress of this pilot, I can see that a change management strategy is required to support the transition from traditional to this type of learning environment. The next phase of the project will require less change for the trades involved and, as everyone embraces the different way of teaching and learning, more focus will be on assisting the apprentice.

The FIATT pilot project to this point can be regarded as a success for everyone involved. The final phase will begin in October 2017, when Levels 2 and 4 will be delivered to another 88 to 100 apprentices.

About the Author:

Dalton Mervold, Saskatchewan Polytechnic

Dalton is Program Head at Saskatchewan Polytechnic's School of Transportation. He is an educator with a specialization in distance and online course design. Using communication tools, he strives to improve the interaction between learners and course facilitators. In this way, he looks for new ways to deliver training allowing learners to remain employed while they complete their education. Being a true lifelong learner, Dalton has a M.Ed., an Advanced Graduate Diploma in Technology, a Masters of Distance Education, a Leadership Excellence Certificate and a Red Seal in the parts person and machinist trades.

Leveraging FAST BC as a Solution for Apprentices & Trade Qualifiers

Lawrence Parisotto, LRP Consulting

Background

FAST BC (Facilitating Access to Skilled Trades in BC) is a resource for qualified, trained tradespersons approved to immigrate to Canada and for BC employers who need a skilled workforce. FAST BC's goal is to connect employers with skilled new Canadians and prepare internationally trained tradespersons for jobs that effectively use their talents.

The WorkBC 2025 Labour Market Outlook[1] indicates British Columbia expects to create a million jobs over the next ten years. A lack of skilled workers, especially in trades, already results in lost economic opportunities of several billion dollars for the province. Experienced immigrant workers, who have specialized skills and are planning to move to BC, can help fill labour shortages arising from an aging workforce and other factors. Despite the need for skilled workers, many recent skilled and experienced immigrants who want to work in their skilled trade or a related occupation indicate they face many challenges in gaining employment and/or certification in Canada.

Prior to leaving their home country for Canada (pre-arrival phase), immigrants have difficulty accessing needed information to better prepare for work in Canada. When they do, they often receive differing and inconsistent perspectives, depending on the province or territory contacted and whether the information is provided by a credentialing organization, industry stakeholder or training organization. Thus, for pre- and post-arrival immigrants, there may be substantial variability of the following:

- information about regional and/or national trade standards and requirements
- a comprehensive assessment of knowledge, skills and abilities (competence) and how they compare to regional and/or national standards
- clear information about gaps in skills and competencies and the training required

Skilled immigrants need better pre-arrival employment services, including information about the labour market and employment opportunities, as well as referrals to more detailed, occupation-specific information, resources and assessments to better recognize relevant and appropriate training and experience. Providing this information, knowledge and skills assessments, and gap training may provide significant benefits for pre-arrival clients and reduce the time needed in

[1] WorkBC 2025 Labout Market Outlook. Government of British Columbia. [Available online: https://www.workbc.ca/getmedia/00de3b15-0551-4f70-9e6b-23ffb6c9cb86/LabourMarketOutlook.aspx]

their post-arrival phase to gain meaningful employment or ready themselves for the certification challenge process.

Unfortunately, many new immigrants cannot access these services or gain this information until months or years after arrival in Canada, significantly delaying their entry into the workforce. FAST BC provides this pre-arrival support for immigrants who are seeking jobs in skilled trades and related occupations in Canada. Specifically, FAST BC:

- helps clients understand the expectations of the Canadian workplace
- helps clients evaluate their skills and knowledge before arrival in Canada
- provides access to online gap training to assist in upgrading needed knowledge and skills

FAST BC also helps clients to build professional networks in BC and provides a place for clients to show their skills and experience to BC employers.

FAST BC is not a course or training program, nor an abbreviated option for formal training, and does not provide certification or a credential – it provides clients access to services that will help them better prepare for employment and become aware of Canadian standards for their occupation and/or credentials or certification in their skilled trade before they arrive in Canada. For the purposes of this article, in the skilled trades context:

- a credential is a general term used to describe certificates, diplomas, degrees or other educational levels earned,
- certification is used to describe a certificate earned such as certificate of completion or certificate of apprenticeship,
- qualification is used to describe a certificate of qualification.

FAST BC services include:

- evaluation of academic credentials (if required)
- familiarization with Canadian occupational descriptions, training and certification; essential skills; and workplace culture, communication, teamwork and initiative
- a comprehensive assessment and report of knowledge, skills, and abilities (competence) for their trade and how they compare to BC or Canadian standards
- upgrading knowledge and skills to meet BC or Canadian standards in required areas through online training
- career advice from local mentors and connections to potential employers

To qualify for FAST BC, eligible clients must be approved to immigrate to Canada and must have two to five years of work experience in one of the approved trades or in a related occupation. Though designed primarily for immigrants in the pre-arrival phase, eligible clients that initiated their assessments while out of Canada may continue in the project after arrival in Canada.

For employers seeking qualified employees, benefits include:

- connecting with skilled immigrants with an international perspective
- gaining a competitive edge by creating a diverse, inclusive workplace

The FAST BC Project is a partnership of the Immigrant Employment Council of British Columbia (IEC-BC) who led the project, and the British Columbia Institute of Technology (BCIT), who designed, developed and implemented the FAST BC competency assessment and gap training components of the project. Both IEC-BC and BCIT worked closely with vendors such as InSite Information Systems (developers of the Shift iQ platform), the Information and Communication Technology Council (ICTC) (JobConnect platform), and Talentova (MentorMatch ementoring platform). The FAST BC Project was funded by Immigration, Refugees and Citizenship Canada (IRCC) as part of a funding initiative to improve pre-arrival services for skilled immigrants.

Introduction and Conceptual Approach

In today's rapidly evolving labour market, employers are indicating the need for a mix of technical and professional skills for entry-level positions across a broad variety of occupations. Implementation of competency-based frameworks and flexible learning models, along with adaptive and proficiency-based credentials (e.g., badges), are increasingly being adopted in education and training for this purpose.[2]

In Canada, a recent report by the Canada West Foundation[3] indicates that Canada is behind in competency training, and that other countries who are our global competitors are doing better at certifying their workers as truly skilled and competent for their jobs. The report summarizes: "Competence is ultimately the best credential."

As a result, provinces and territories in Canada are placing an emphasis on skilled workforce development, such as the Ontario Highly Skilled Workforce initiative.[4] In the United States, similar recent reports and calls for competency-based education (CBE) and competency-based credentialing systems are equally urgent.[5]

[2] Preparing Students for Competency-Based Hiring. EduCause Review. December, 2014 [Available online: http://er.educause.edu/blogs/2014/12/preparing-students-for-competencybased-hiring]
[3] Competence is the Best Credential. CanadaWest Foundation. April 7, 2015. [Available online: http://cwf.ca/publications-1/competence-is-the-best-credential]
[4] Highly Skilled Workforce Initiative. Province of Ontario. [Available online: https://www.ontario.ca/page/building-workforce-tomorrow-shared-responsibility]
[5] The Time for Competency-based Credentialing Systems is Now. Jobs for the Future. April 11, 2014. [Available online: http://www.jff.org/blog/2014/04/11/time-competency-based-credentialing-systems-now]

Competency-based education programs enable learners to earn credentials or certifications by demonstrating competencies (defined as the knowledge, skills and abilities) to be proficient in their occupation. An effective CBE program clearly articulates what constitutes the credential or certification, as well as the corresponding competency framework that defines proficiency. A well-defined competency framework is the foundation of a CBE program and guides the development of the curriculum, and the integration of theoretical and practical knowledge, skills and abilities needed to demonstrate competence.[6]

Many occupations and professions such as apprenticeship and trades, allied health disciplines, and others already use an established and effective competency-based approach. This approach refers to a system of training, assessment, evaluation and reporting based on learners demonstrating they have gained the knowledge, skills and abilities expected or required.

Typically, certifying, regulatory or professional accrediting bodies develop entry-to-practice competency frameworks or profiles for learners to become credentialed in an occupation. The competency profile is a document that lists the outcomes or competencies that a learner must have at the entry-to-practice level for the occupation. Training programs use the competency profiles to develop curriculum guides and learning resources. Learning how to do these tasks and achieve the competency needed for safe and effective practice requires knowledge, skill and abilities typically achieved through a combination of a training program and workplace training. Curriculum includes both the theory that is taught and assessed in a classroom setting, and the skills and application of theory that are reinforced, and sometimes evaluated, during work experience.

Skilled trades training programs have utilized competency-based education for decades in Canada and so have well-established corresponding educational and administrative processes. However, the traditional approach has been to develop *competency frameworks and curriculum guides that use competencies based on regional or jurisdictional needs assembled into discrete, ordered and structured hierarchies (e.g., line items, competencies, tasks) such as in technical training levels.*

A new approach utilizing a granular, comprehensive, competency repository of all known relevant competencies can be built into a wide array of hierarchical frameworks and flexible learning approaches, can support a systemic approach to qualification and certification and can further:

- set a measurable standard for an evolving occupation
- improve efficiency and flexibility of delivery

[6] Creating a Competency-Based Credentialing Ecosystem. Corporation for a Skilled Workforce. April, 2014 [Available online: http://www.clasp.org/resources-and-publications/files/Developing-a-Competency-Based-Credentialing-Ecosystem.pdf]

- improve learner satisfaction and completion rates
- provide learners with clear and defined paths for completion of qualification and certification, even as those requirements change
- provide the groundwork for workplace and prior learning assessments
- strengthen the relationship between training, assessments, and certification

The FAST BC flexible learning approach utilizes a competency repository and common library of existing common and/or specific learning materials and resources referenced with individual *granular elements* of the competency framework – think of these as competency 'bingo balls.' The bingo balls can be populated in the competency repository from any one or more competency frameworks such as provincial, interprovincial, National Occupational Analyses, Red Seal Occupational Standard or harmonized program outlines. For each competency, relationships to diagnostic assessments, learning materials and post-assessments are also done at the granular level.

In the case of the FAST BC Project, the competencies are built into thematic frameworks, i.e., all competencies, both theoretical and practical, for that theme are included in the theme hierarchy. For example, for carpenter, all concrete competencies are in the Concrete theme. In the level approach, some competencies within a theme may exist in different levels and it is difficult to assess immigrant client's knowledge for a specific aspect or aspects of the carpenter trade unless they are assessed across multiple levels. (See Appendix A or the BC Carpenter Program Outline at http://www.itabc.ca/sites/default/files/docs/carpenter-program-outline-jan-2017-harmonized.pdf).

This approach is no different from existing training processes in that the same outlines, approved curriculum and assessments can be used but, rather than an implicit and loosely-coupled relationship between these as is generally the case, the FAST BC approach *explicitly* creates all of these relationships within the educational technology tool used, Shift iQ. Additionally, these explicit relationships can be built in any order into any number of competency themes, hierarchies or outlines.

A key aspect for immigrant newcomers to Canada is to get them employed in their occupation, a limited role or aspect of their occupation, or a related occupation. Initial employment relevant to their experience, knowledge and skills in their field is crucial for their career pathway, contribution to the Canadian economy, apprenticeship or training opportunities, and possible attainment of certification. In this new approach, competency frameworks built from specific competencies can be established not only for a specific skilled trade or specific aspects of it, but also in reference to other related trades that utilize the same or similar competencies. This broader perspective may provide for more success in finding appropriate areas of employment for immigrants.

Primary occupations and competency frameworks are ones that clients would be intending to attain on immigration in Canada. Depending on the mapping of standards between the Canadian standards and the standards of the program or training in the client's country of origin though, the client may be assessed and appropriately matched to all or only specific aspects of the trade, or a secondary or related occupation to achieve employment. For example:

- Primary: Carpenter – not sufficient knowledge, skills and abilities for overall trade knowledge, but some Industrial, Commercial, Institutional (ICI) knowledge.
- Secondary or related: Residential Framing Technician, Construction Craft Worker, Construction Formwork Technician; some or all knowledge, skills and abilities.

Knowledge and Skills Assessment, and Gap Training Methodology

The FAST BC Project utilized in part a 'competency to credential' approach for flexible learning in the trades.[7][8] In early 2013, using a process combining challenge-driven innovation, iterative design and collaborative leadership, BCcampus, in partnership with go2HR, developed this approach for a project aimed at alleviating current issues and challenges in Professional Cook training and certification, where teaching, learning and credentialing are defined by competency frameworks.[9] This resulted in improved challenge success rates in those cooks who had gained most of their experience on the job, but were either unsuccessful in challenging the Red Seal examination or practical assessment, or who had been identified as having substantial gaps in prior learning during the application process.[10]

'Competency to Credential' uses innovative educational technologies,[11] such as Totara and Shift iQ, to better deliver and support education and training in competency-based disciplines, such as those in trades and health care. It utilizes a competency repository based on recognized and approved competency profiles as a fundamental basis for all teaching and learning that occurs through to the achievement of a credential.

[7] BCcampus White Paper Explores Disruptive Innovation Within Trades Training in BC. (Vancouver: BCcampus, 2014) https://bccampus.ca/2015/02/02/bccampus-white-paper-explores-disruptive-innovation-within-trades-training-in-b-c/

[8] Lawrence Parisotto and Michelle Glubke. Competency to Credential: An Alternative Model for Flexible Learning in Trades Training in British Columbia and Beyond (Vancouver: BCcampus, 2014) https://bccampus.ca/files/2015/02/Competency-to-Credential-White-Paper-Revised-Feb-26-2014-Final.pdf

[9] Professional Cook Gap Training Program: Status Report. (Vancouver: BCcampus, 2014) https://bccampus.ca/2015/04/28/professional-cook-gap-training-program-status-report/

[10] Top 8 Facts About Our Profesional Cook Gap Training Pilot Program (Vancouver: BCcampus, 2014) https://bccampus.ca/2014/06/05/top-8-facts-about-our-professional-cook-gap-training-pilot-program/

[11] The Need for Tools in CBE. (Vancouver: BCcampus, 2014) https://bccampus.ca/2015/01/27/the-need-for-tools-in-competency-based-education/

'Competency to Credential' was initially conceived for the delivery of new "horizontal" competency profiles introduced as a result of changing health care strategies across several "vertical" health care professions. Horizontal competencies are those that are common across several disciplines or credentials; vertical competencies are specific to each discipline or credential. The goal was to design a flexible, more efficient, systemic model for delivery of education and training in evolving occupations and professions that is adaptive and specific to individual learning needs, rather than an approach that does not recognize prior learning and/or an approach that trains all learners in all competencies, whether they are needed or not.

The initial focus of 'Competency to Credential' for Professional Cook Gap Training[12] was on collaboratively developing a model for prior learning assessment, individual learning plans and gap training that would facilitate:

- a comprehensive and coordinated approach to meeting learners' needs in achieving the knowledge, skills and/or credentials required to enter the job market
- better preparation for and faster attainment of credentials required for certifications
- better access to and flexibility of gap training delivery
- more efficient development and use of common open educational and curricular resources that reduce redundancies

The competency to credential approach refined for trades training in the Professional Cook Gap Training Project developed in association with go2HR and the Industry Training Authority (ITA) was designed to alleviate or solve challenges with trades training, including:

- lack of remediation at the competency level
- lack of ability to teach and recognize achievement of common competencies across trades programs
- lack of consistent documentation of workplace experience
- difficulty performing prior learning assessments comprehensively and consistently
- lack of ability to create individual learning plans and gap training based on individual assessments
- difficult and inconsistent foreign credential recognition
- need for better training and labour market mobility for Certificates of Qualification technical training levels and Red Seal

The notion of a competency-centric, flexible learning approach was further refined for the FAST BC Project. The FAST BC project team was comprised of a multi-disciplinary team including subject-matter experts, instructional designers and developers, educational technologists and vendors relying on stakeholder input and client needs. The project team utilized a similar

[12] Competency-Based Education: Training for the Gap. (Vancouver: BCcampus, 2014) https://bccampus.ca/2014/12/16/competency-based-education-training-for-the-gap/

collaborative innovation process for design and development of the project that included four key aspects:

- challenge-driven innovation – challenges associated with the current process were identified, analyzed and solutions proposed to resolve or reduce them
- collaborative innovation – the proposed solutions were a product of all stakeholders input and met their needs through a collaborative and consultative process
- life cycle approach – the solutions recommended were to be implemented in a phased approach to effectively scale out a systemic solution. Phases included design, limited pilot, expanded pilot, pre-production and, finally, operationalization of the solution with evaluation of progress at each phase
- iterative design – the evaluation of each phase resulted in modifications ensuring an effective systemic solution

The three key aspects of the approach utilized for the FAST BC Project were:

- a competency repository that links competency frameworks to curricular resources at a granular level
- a common library of shared curriculum development and training delivery through a library of common learning resources
- flexible blended and online delivery for both technical theory and workplace practical training preparation through use of competency-based educational technologies

In order to develop a quality framework for assessment and gap training, strengths and challenges of the existing immigrant assessment and training system and process were considered. Challenges included:

- lack of consistent and comprehensive methods for assessment and recognition of prior learning and experience
- variation or lack of use of standards to compare and assess prior learning and experience against inconsistent reporting of prior learning and experience recognition and resulting recommendations
- 'competency bingo' – lack of a clear indication of what gaps need to be addressed for immigrants to achieve employment and/or certification
- the perception that gap training is not a traditional or widely accepted approach to knowledge up-skilling

The FAST BC Project was designed and developed to help alleviate these barriers and challenges. It does so by individual assessments in which clients:

- are made aware of competency framework they are assessed against
- are assessed against the framework with an indication of what competencies are successfully assessed and, in some cases, at what proficiency level
- have gaps identified, provided individualized training and post-assessment in preparation

for employment or the challenge process
- are provided a competency portfolio report that may be shared with mentors, potential employers, or credentialing or certifying organizations

It should be noted that the FAST BC Project was not a curriculum development exercise. New learning resources were not developed in isolation and specifically for use in this project. Well-designed and developed curriculum, assessments and other learning resources have already been developed, reviewed and specified by groups such as provincial jurisdictions and articulation committees, and are already in use.

In order for the FAST BC gap training to be effective and efficient, and coordinate well with certification and challenge pathways, these same materials have been used in the FAST BC Project, albeit at a granular level. Because of the flexible delivery nature, they are provided in digital formats such as ebooks, available through Texidium access, or by means of LTI integrations to specific ebook sections with the Shift iQ system.

Using these resources for assessments (diagnostic and post-tests) and learning resources gap training lessons) should allow for the FAST BC knowledge and skills assessment to provide valid assessments and gap training with a valid prognosis of certification and/or examination success with credentialing organizations. Results of clients who complete the FAST BC knowledge and skills assessments will be evaluated in this regard, however, there is an insufficient number of clients to comment on the prognostic validity of the assessments.

Learning resources were provided to the project from recognized and approved sources such as:
- Province of BC/Industry Training Authority of BC Provincial Apprenticeship Binders (Carpenter)
- Nelson Education (Carpenter, Automotive Service Technician)
- Pearson Canada (Carpenter)
- PanGlobal Training Systems (Power Engineer, Fourth Class)

In all cases, these resources were explicitly related at a granular level to the competencies in the repository, both directly and contextually, wherever possible.

A thematic approach rather than a level structure was utilized for the relationships organizing competencies, assessments and learning resources within the database and hierarchy. Subject-matter experts from each area identified all relevant training topics, or line items, of the occupational analysis and their relationships with other topics. All competencies and tasks in each topic or line item were then related with each theme. In one case (Automotive Service Technician), competencies within a theme were also broken into entry, intermediate and advanced level competencies. In another case (Carpenter), competencies related to Industrial,

Commercial, Institutional (ICI) construction were also attributed to a separate ICI assessment framework.

As an example, for the Concrete theme of Carpenter (Concrete is one of seventeen themes of the Carpenter assessment), relationships for granular learning resources were created for all competencies within the Concrete theme. Thus, incorrect responses on specific questions that are tagged by competency in the Concrete theme diagnostic knowledge assessment will release gap training lessons containing the specific granular content associated with that question, which will further release post-assessments.

In the case of the FAST BC Carpenter assessment schema, a threshold of 50% in a given theme is required to release the gap training lessons. A knowledge level below that in a given theme may not allow for effective gap training if a sound basis of knowledge and experience does not exist to contextualize the gap training. (Eligible clients must have training and experience in their home country.)

Diagnostic knowledge assessments have a pass mark of 70% consistent with competency evaluations and for prognostic purposes; in this case, gap training lessons are released only for the client to address areas in which they may be weak.

Practical assessment examples and preparation are only provided and released for themes in which clients have successfully indicated appropriate theoretical knowledge (i.e., >70% on either the diagnostic or post-assessments). See Appendix A for sample screen shots.

FAST BC Client Experiences, Benefits and Results

"For professional immigrants like me lands in Canada with lots of question and uncertain where to begin with. Main worry is how to align home country's experience and education in Canadian market so that professional status of home country can be achieved in Canada fast. FastBC's program has all solution of my question and most importantly a "Plan" to work on with dedicated support." I can rest my worries to whom to approach and where to go with FastBC."
FAST BC Power Engineer Client

The aspects of the knowledge and skills assessment that benefit clients of the FAST BC Project include:

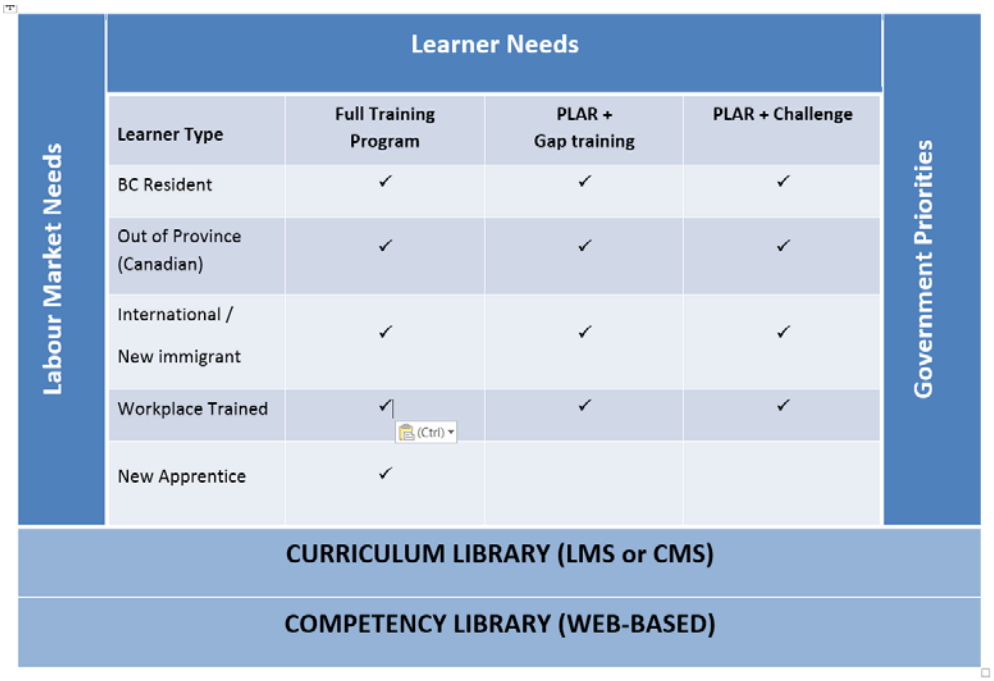
- an introduction to occupations, essential skills, safety concerns, culture, communication, teamwork and initiative in the Canadian workplace
- thematic, diagnostic knowledge assessments of representative knowledge of all competencies of the occupation

- an individualized custom learning plan with content and post-assessments generated based on diagnostic assessments related to granular aspects of competency framework
- a competency portfolio report of the client's results
- support of an Assessment Coordinator throughout the FAST BC experience
- follow up mentoring and networking support

The FAST BC Project will follow clients through to their employment to evaluate how the project has benefited them. At this stage, clients have yet to complete the full FAST BC assessment and gap training process and other services, or proceed to the employment-seeking phase, thus results are not yet available. However, in the development, implementation and communication of the FAST BC Project, significant interest has been indicated for other uses of the approach.

Discussion and Other Opportunities

The benefits of the FAST BC Project for pre-arrival immigrants have been indicated. The scalable and sustainable approach to the FAST BC knowledge and skills assessment and gap training components may also be considered for other client groups. Personalized and adaptive learning such as the FAST BC approach can be used for all learner types and needs, especially because they are designed using the same learning resources used in apprenticeship training, rather than re-developing additional resources on a specific project basis. Consider the matrix of client groups shown below:



Source: BCcampus/go2HR

While the FAST BC Project was intended and developed for one client group or cell of this matrix (International/New Immigrant, PLAR + Gap Training to prepare clients for the challenge process), it was designed with a broad perspective to accommodate other skilled trades and skilled trades client types, such as domestic apprentices or trades qualifiers (as defined by the Canadian Apprenticeship Forum at http://caf-fca.org/apprenticeship-in-canada/apprenticeship-101/ and http://caf-fca.org/ftpuploads/Documents/Newcomer1_2012.pdf). The same methodology may assist these client types in improving completion and examination pass rates. Trades qualifiers, for example, report many issues[13] with being successful in the challenge process and examinations.

Other uses might include:

- assessment of apprentices prior to or on return to technical training levels to identify and address gaps or areas of weakness
  - Trades instructors often remark that, given the variety of apprentice experience in the work experience portion of training, apprentices return to the next level of technical training with substantially different experiences and knowledge. Gap training may be of benefit
- assessment and gap training (theory and practical) for industry stakeholders and employers who seek certain skill sets (e.g., Industrial, Commercial, Institutional carpenter skills) for non-regulated trades
  - Employers of workers in non-regulated trades often seek workers with a specific set of skills and abilities (e.g., for ICI work, Concrete, Horizontal Formwork and Vertical Formwork) rather than a full scope of an occupational skills set

All of these potential other uses can be achieved by leveraging the FAST BC environment and all, to some degree, may assist in helping apprentices and trades qualifiers be successful, building a highly skilled workforce and addressing regional skills gaps.

Many jurisdictions are grappling with skills gaps and the skills needed for their future workforce. Many are attempting to implement integrated strategies to assist in training their current and future workforce to adapt to new and evolving demands and disruptions in their occupations and professions as a result of their new economies. The Province of Ontario[14] indicates in their report "Building the Workforce of Tomorrow: A Shared Responsibility that "successful skills

[13] Apprentices in Canada ePanel Research Report: Apprentice Attitudes Towards Learning and Examinations. Canadian Apprenticeship Forum. Ottawa. January 2017. [Available online: http://caf-fca.org/wp-content/uploads/2017/01/Member11-Exam-Supports-2.pdf?utm_source=Member+Only+AI+-+March+2017&utm_campaign=AI_38&utm_medium=email]

[14] Building the Workforce of Tomorrow: A Shared Responsibility. The Premier's Highly Skilled Workforce Expert Panel. Province of Ontario. June 2016 [Available online: https://www.ontario.ca/page/building-workforce-tomorrow-shared-responsibility]

training is a foundational aspect of local economic development and an important aspect of a highly skilled workforce."

However, the report also indicates that counter to these strategies are troubling trends in essential skills such as literacy and numeracy, and that Canadians and Canadian organizations are ill-prepared for economic change. The report also references a survey by the Business Council of Canada that found skills gaps or shortages exist in certain Red Seal trades dependent on regional economic needs.[15]

Aspects such as these can be partially alleviated by having more apprentices and trades qualifiers successfully complete training, certification and challenge examinations. According to the Canadian Apprenticeship Forum,[16] apprentices who earn certification are more likely to be employed, but they face challenges in completing their programs. Increasing the completion rates among apprentices already in the system may be another way of increasing the supply of certified tradespeople.

Trades qualifiers though may also face challenges and have difficulty successfully preparing for and passing examinations. Thus, supporting trades qualifiers to assess their knowledge and skills, identify gaps and provide appropriate gap training, both for theoretical and practical competencies, may help improve success rates of qualifiers. This may also help provide the highly skilled workforce needed to maintain current and adapt to new economies and should be explored further.

The FAST BC approach may be leveraged to help increase the numbers of successful completers of trades certifications. In particular, the FAST BC knowledge and skills assessments, and gap training approaches, may be well suited to this. The diagnostic assessment and resulting individualized learning plan that includes gap training and post-tests may potentially alleviate challenges for both apprentices and trades qualifiers by providing additional preparation and resources that:

- provide thorough diagnostic assessment of knowledge with related prognosis of likelihood of success for certification or challenge examination
- provide gap training and post-tests in areas of insufficient knowledge

In order to explore this further, we invite interest and participation in project proposals for Carpenter and Automotive Service Technician apprentices and trades qualifiers to evaluate if completion outcomes can be improved. Please contact the authors or Canadian Apprenticeship

[15] Business Council of Canada. Developing Canada's future workforce: a survey of large private-sector employers. 2016. Accessed April 2016.

[16] Apprentices in Canada ePanel Research Report: Apprentice Attitudes Towards Learning and Examinations. Canadian Apprenticeship Forum. Ottawa. January 2017. [Available online: http://caf-fca.org/wp-content/uploads/2017/01/Member11-Exam-Supports-2.pdf?utm_source=Member+Only+AI+-+March+2017&utm_campaign=AI_38&utm_medium=email]

Forum should your organization or jurisdiction have interest in proposing and participating in such projects.

Funding and Support

The FAST BC Project was funded by Immigration, Refugees and Citizenship Canada. Special thanks for project support provided by:

- InSite Information Systems, developers of Shift iQ

Thanks for project support also to:

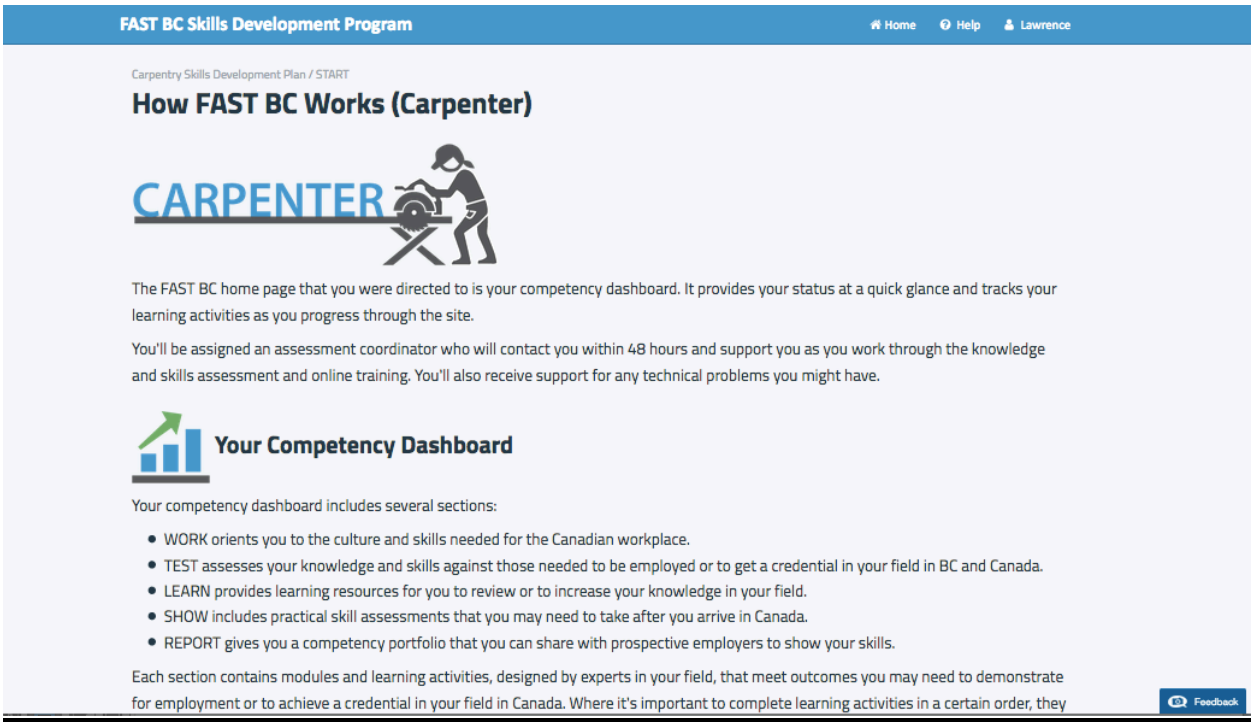
- Province of BC/Industry Training Authority of BC
- Nelson Education
- Pearson Canada
- PanGlobal Training Systems

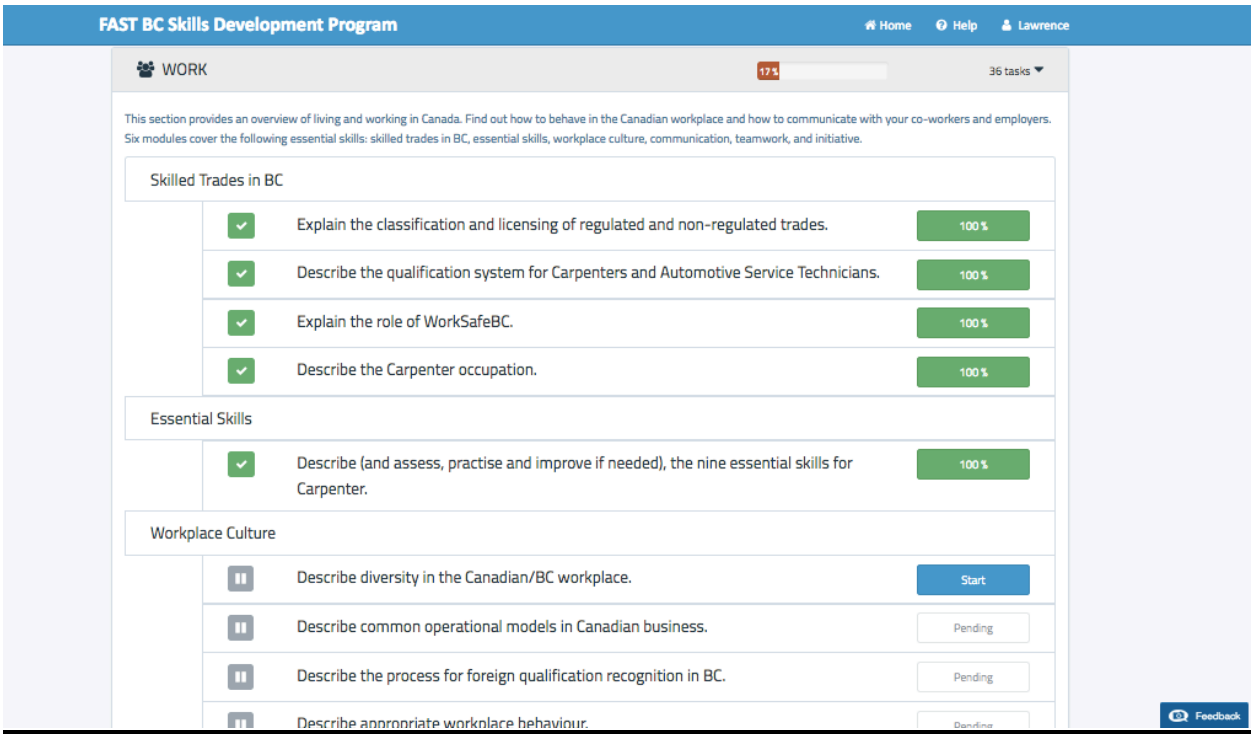
About the Author:

Lawrence Parisotto, LRP Consulting

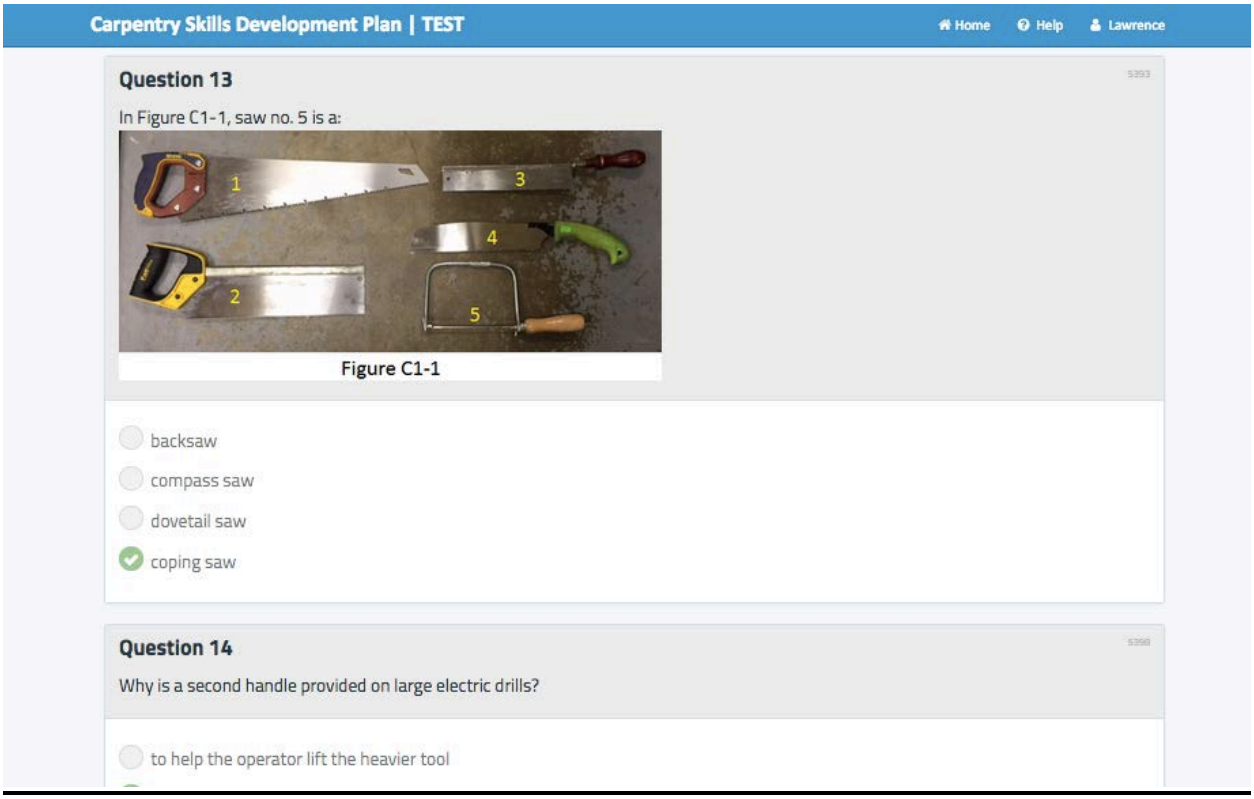
Lawrence is an educational consultant at LRP Consulting working on the FAST BC Project (fastbc.org) with the Immigrant Employment Council of BC (IEC-BC) on behalf of the British Columbia Institute of Technology (BCIT). Previously, Lawrence was the Director of Education Projects, Shared Services and Collaborative Programs at BCcampus. As Director, he led the E-PPRENTICE initiative sponsored by BC's Industry Training Authority (ITA). Over his career, Lawrence has held various positions at BCIT, including the Director of Media and Technology Services in the BCIT Learning and Teaching Centre and project lead for projects in the BCIT Technology Enabled Knowledge Initiative. Lawrence has broad experience in a variety of online, flexible and classroom educational technology applications for academic, technology, trades and apprenticeship training programs. These include competency-based and adaptive learning environments, distributed and online learning environments and collaborative leadership and innovation.

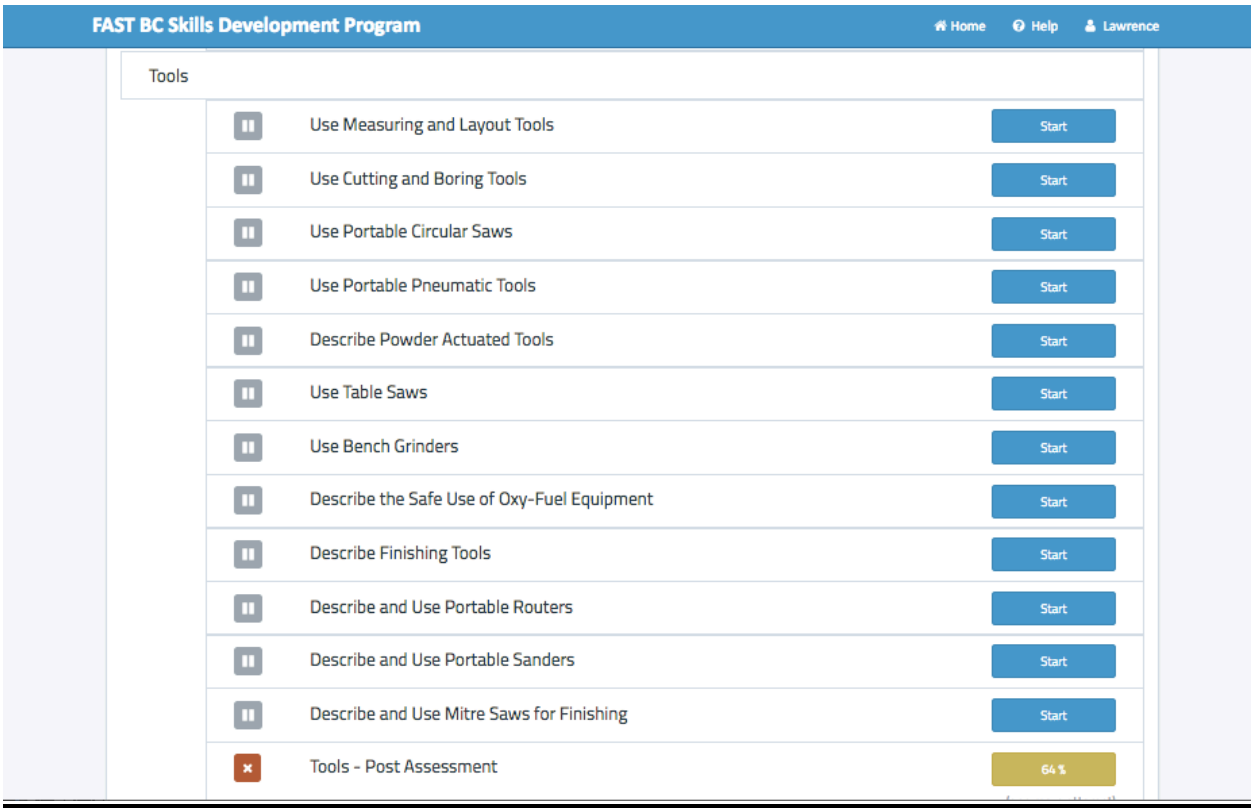
Appendix A: FAST BC Carpenter Environment Screen Shots

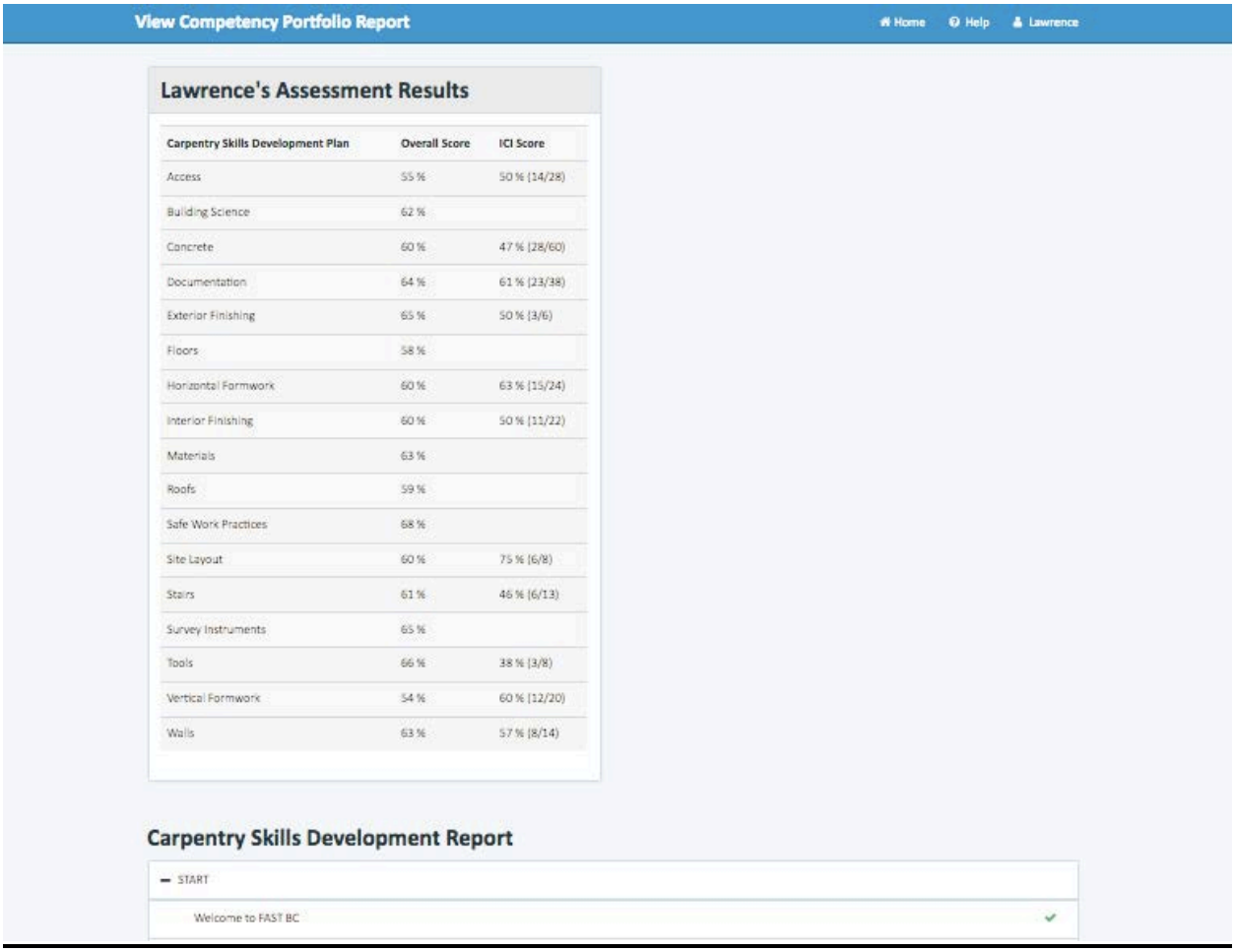



FAST BC Skills Development Program
Home
Help
Lawrence
WORK
17 %
36 tasks
This section provides an overview of living and working in Canada. Find out how to behave in the Canadian workplace and how to communicate with your co-workers and employers. Six modules cover the following essential skills: skilled trades in BC, essential skills, workplace culture, communication, teamwork, and initiative.
Skilled Trades in BC
Explain the classification and licensing of regulated and non-regulated trades.
100 %
Describe the qualification system for Carpenters and Automotive Service Technicians.
100 %
Explain the role of WorkSafeBC.
100 %
Describe the Carpenter occupation.
100 %
Essential Skills
Describe (and assess, practise and improve if needed), the nine essential skills for Carpenter.
100 %
Workplace Culture
Describe diversity in the Canadian/BC workplace.
Start
Describe common operational models in Canadian business.
Pending
Describe the process for foreign qualification recognition in BC.
Pending
Feedback


FAST BC Skills Development Program
Home
Help
Lawrence
WorkSafeBC Occupational Health and Safety Regulations
BC Building Code (access code required: User ID - bcit; Password - bcbc)
Safe Work Practices
68 %
Documentation
62 %
Tools
69 %
Survey Instruments
65 %
Access, Rigging and Hoisting
55 %
Site Layout
58 %
Concrete
60 %
Vertical Formwork
55 %
Horizontal Formwork
60 %
Materials
63 %
Floors
58 %
Walls
68 %
Roofs
56 %
Stairs
54 %
Exterior Finishing
65 %
Interior Finishing
60 %
Building Science
62 %


Carpentry Skills Development Plan | TEST
Home
Help
Lawrence
Question 13
In Figure C1-1, saw no. 5 is a:
1
2
3
4
5
Figure C1-1
backsaw
compass saw
dovetail saw
coping saw
Question 14
Why is a second handle provided on large electric drills?
to help the operator lift the heavier tool


FAST BC Skills Development Program
Home
Help
Lawrence
Tools
Use Measuring and Layout Tools
Start
Use Cutting and Boring Tools
Start
Use Portable Circular Saws
Start
Use Portable Pneumatic Tools
Start
Describe Powder Actuated Tools
Start
Use Table Saws
Start
Use Bench Grinders
Start
Describe the Safe Use of Oxy-Fuel Equipment
Start
Describe Finishing Tools
Start
Describe and Use Portable Routers
Start
Describe and Use Portable Sanders
Start
Describe and Use Mitre Saws for Finishing
Start
Tools - Post Assessment
64 %


View Competency Portfolio Report
Home
Help
Lawrence
Lawrence's Assessment Results
Carpentry Skills Development Plan
Overall Score
ICI Score
Access
55 %
50 % (14/28)
Building Science
62 %
Concrete
60 %
47 % (28/60)
Documentation
64 %
61 % (23/38)
Exterior Finishing
65 %
50 % (3/6)
Floors
58 %
Horizontal Formwork
60 %
63 % (15/24)
Interior Finishing
60 %
50 % (11/22)
Materials
63 %
Roofs
59 %
Safe Work Practices
68 %
Site Layout
60 %
75 % (6/8)
Stairs
61 %
46 % (6/13)
Survey Instruments
65 %
Tools
66 %
38 % (3/8)
Vertical Formwork
54 %
60 % (12/20)
Walls
63 %
57 % (8/14)
Carpentry Skills Development Report
START
Welcome to FAST BC

Canadian Apprenticeship Forum
Forum canadien sur l'apprentissage

THE CANADIAN APPRENTICESHIP JOURNAL

JOURNAL CANADIEN DE L'APPRENTISSAGE