

Canadian Manufacturing Network

# Workplace Literacy and Essential Skills Research

BCT

Plumber's Training Program



Prepared by:

Canadian Manufacturing Network,  
Div. of Excellence in Manufacturing Consortium

Research Authors: L. Gillis, Ph.D., and A. Bailey, 2015

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## Case Study

### BCT: Plumber's Training Program

By Canadian Manufacturing Network with research & report contributed by Lynette Gillis Ph.D. & Allan Bailey, Centre for Learning Impact

#### Study Background

**Overview of BCT Structures** BCT Structures Inc. custom designs and manufactures a wide range of modular buildings including: workforce housing, office complexes, schools, lavatories, multi-story buildings, affordable housing, and kitchen facilities. The company is located in Lethbridge, Alberta and is a division of Clean Harbors Energy and Industrial.

**Training Rationale** The plumber's training program was designed to compensate for manpower limitations in the local Lethbridge labourforce as well as to address existing skills gaps in the company's workforce. Because Lethbridge is a smaller community located some 200 kilometers from Calgary, there are often shortages of qualified tradesmen such as plumbers, electricians, etc. For BCT, these labour shortages can have a substantial impact on productivity during busy periods. The goal of the training was to expand the skill set of several designated production workers to include plumbing skills in order to increase overall workforce production effectiveness and flexibility. It was expected that this initiative would be a win-win for employees as well as the organization. Since BCT has skill-based competency pay, the more expertise an employee gains, the more he/she is paid.

**The Training** The training program was created in partnership with Lethbridge College. Ten employees took the program, which was conducted over a 4-week period starting in early January 2015. Sessions of approximately 3 hours were scheduled twice a week, after work hours. Total training time was 25 hours.

The program consisted of approximately 30% theory and 70% hands-on practice. The theory was presented early in the program and consisted of three main areas: Applied Mathematics (perimeters, areas, volumes, capacities); Percentages and Grades; and Interpretation of Blueprint Packages. The hands-on material included: Hand and Power Tools; Copper Tube, Tubing and Fittings; Plastic Pipe and Fittings; and Iron Pipe and Fittings.

#### Methodology: High Impact Evaluation

**The Case Study Methodology** **The Learning Value Chain™** The BCT Structures case study adopts the Learning Value Chain evaluation approach—the core evaluation framework and instrument-set developed for the Gillis and Bailey High Impact Evaluation model. The Learning Value Chain™ framework offers an uncomplicated, field-tested framework for evaluating the learning effectiveness and the business value of training and human resource investments (Figure 1).

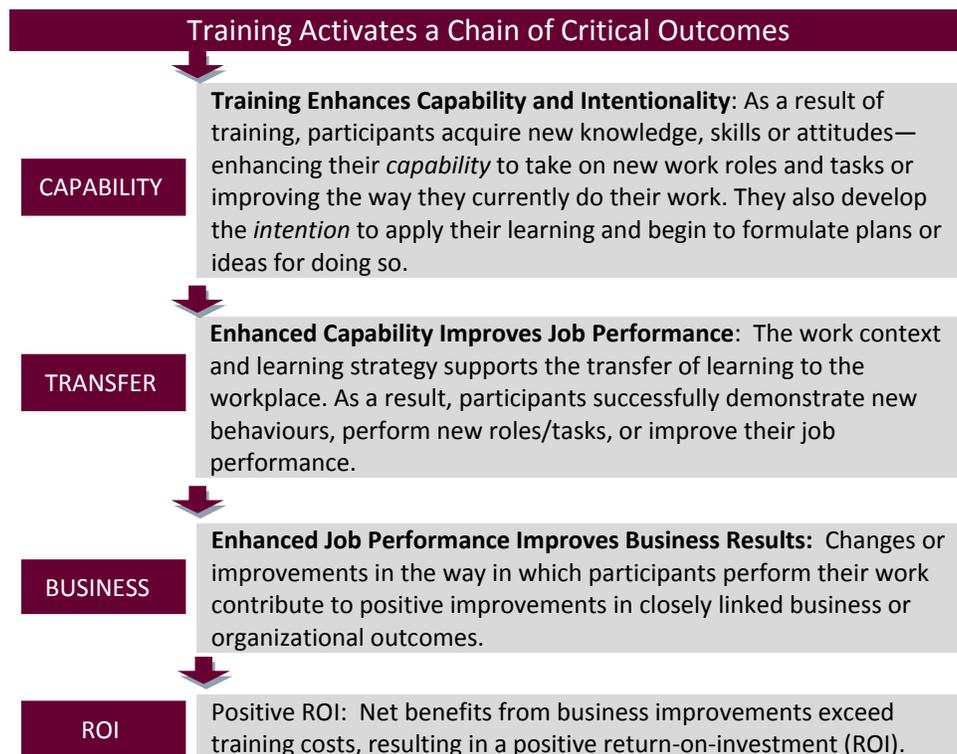


In the Learning Value Chain™, the training program triggers a chain of critical outcomes. Monitoring this chain of outcomes adds an innovative and critically important predictive value to the evaluation process. As desired outcomes are achieved at each link along the chain, greater value is added and the likelihood increases that training will result in positive business outcomes and return on investment. Conversely, if training fails to meet outcomes at any link, value is diminished and the prospect of positive business results and return on investment is at risk.

Using the Learning Value Chain™ framework, the training program is evaluated at each of four links (Capability, Transfer, Business Results and ROI). At each link, data is gathered to assess the extent to which the training has achieved key outcomes, added value and enabled the next critical event in the chain to occur.

The Learning Value Chain™ model also incorporates a diagnostic strategy to investigate training practices and strategies that may strengthen or weaken outcomes at each link and subsequently influence business impact and return on investment.

**Figure 1**  
The Learning Value Chain™



## Capability Results

**Evaluation Questions:** Did training participants develop new *capability*: acquire new knowledge and skills, adopt new attitudes, improve existing skills, or discover new and more productive ways of doing work? Did participants also develop the *intention* to apply their learning or improve their job performance?

### Training enhances skill and had a high impact on other Capability indicators such as Confidence, Motivation and Perceived Value

To assess Capability—the first link in the Learning Value Chain™—BCT course participants were asked to complete two Capability Questionnaires. The first questionnaire, administered after the first 13 hours of training, focused on their training in applied mathematics and blueprint reading. The second questionnaire, administered at the conclusion of the training, focused on basic plumbing skills. All ten participants responded to both questionnaires.

The findings suggest that participants made modest gains in applied mathematics and blueprint interpretation as a result of training. They typically see it as possible to use their learning in the workplace (to a high or moderate degree), and most are highly motivated to do so. However, about half report that the training had not met their skill gaps. They also lack a high degree of confidence in their capability to apply their learning on the job.

The basic plumbing knowledge and skills component of the training course had a greater impact on participants. They indicated that they had learned a lot from their training in this area; it largely met their skill gaps, and most were confident in their capability to apply it. They are also highly motivated to apply it and feel that it will be possible to do so in their specific workplace situations.

Overall, participants perceive the whole of the program as highly valuable.

Key questionnaire results are described below and summarized for all program participants in the Capability Indices (Figure 2 and 3).

### Training in Applied Mathematics and Blueprint Interpretation

- **Knowledge and Skills:** Before training, the largest proportion of participants rated their level of knowledge of applied mathematics and blueprint interpretation as "low" (43%) to "moderate" (35%). Following training, participants rated their knowledge as "moderate" (43%) to "high" (39%). About half the group reported that the training had not met their personal skill gaps in the area. Some commented that the math and blueprint instruction could be improved.
- **Confidence in Applying Learning:** The largest proportion of participants (52%) report a "moderate" level of confidence in their ability to effectively apply their knowledge of applied mathematics and blueprint interpretation in the workplace. Of those remaining, 28% report a "low" degree of confidence and 20% a "high" degree.

- **Motivation to Apply Learning:** 70% report that they are "highly" motivated to apply their newly acquired knowledge and skills.
- **Workplace Readiness:** Most (50%) indicate it will be possible to apply their learning in their specific workplace setting to a "high" degree; 40% indicate to a "moderate" degree; and 10% to a "low" degree.
- **Plans for Action:** Most (50%) have developed at least "some plans or ideas" for using their plumbing skills in their work; 30% percent report having "a lot of plans or ideas" for applying their learning; and 20% have only "a few or no plans or ideas" for application.

### Training in Basic Plumbing Knowledge and Skills

- **Knowledge and Skill in Plumbing:** Before training, 28% rated their knowledge and skill in basic areas of plumbing as "high"; whereas following training, 80% rate their knowledge and skill "high" in these areas (a gain of 52%). Participants also perceive their training as having met their knowledge and skill gaps to a "high" to "moderate" degree (50% and 40% respectively).
- **Confidence in Applying Learning:** Almost three-quarters of respondents (74%) report a "high" degree of confidence in their capability to apply their plumbing knowledge and skills on the job.
- **Motivation to Apply Learning:** 90% are "highly" motivated to apply their skills.
- **Workplace Readiness:** 80% believe it will be possible to apply their knowledge and skills to a "high" degree.
- **Plans for Action:** 50% have developed "several" or "a lot of plans or ideas" for using their plumbing skills in their work; 40% have "some plans or ideas."

Overall, 76% of participants perceive the whole of the Plumber's Training course as "highly" valuable (i.e., credible, practical, relevant, and essential).

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### Effective Practices

The following practices were identified by participants as being "moderately effective" in promoting learning:

- Applying the theory to real-life situations
- Discussions
- Handouts on plumbing theory

The execution of instruction was rated as "highly effective" with regard to:

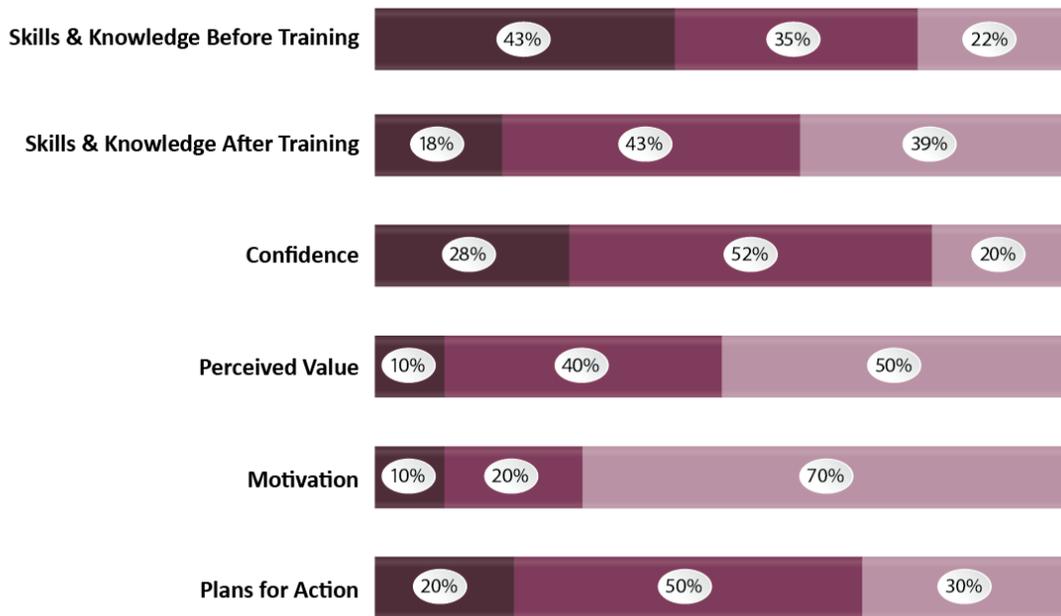
- Engaging and sustaining learners' interest
- Presenting key concepts clearly and logically
- Providing a realistic and work-related practice activity
- Providing useful feedback during the activity

- Providing opportunity for collaboration, discussion, and learning from others
- Providing useful response to questions, guidance or clarification

## Part One of the Course: Applied Mathematics and Blueprint Interpretation

### CFLI Capability Index: BCT Structures

■ **Low Rating:** 1 and 2 on a 5-point scale | ■ **Moderate Rating:** 3 on a 5-point scale | ■ **High rating:** 4 and 5 on a 5-point scale

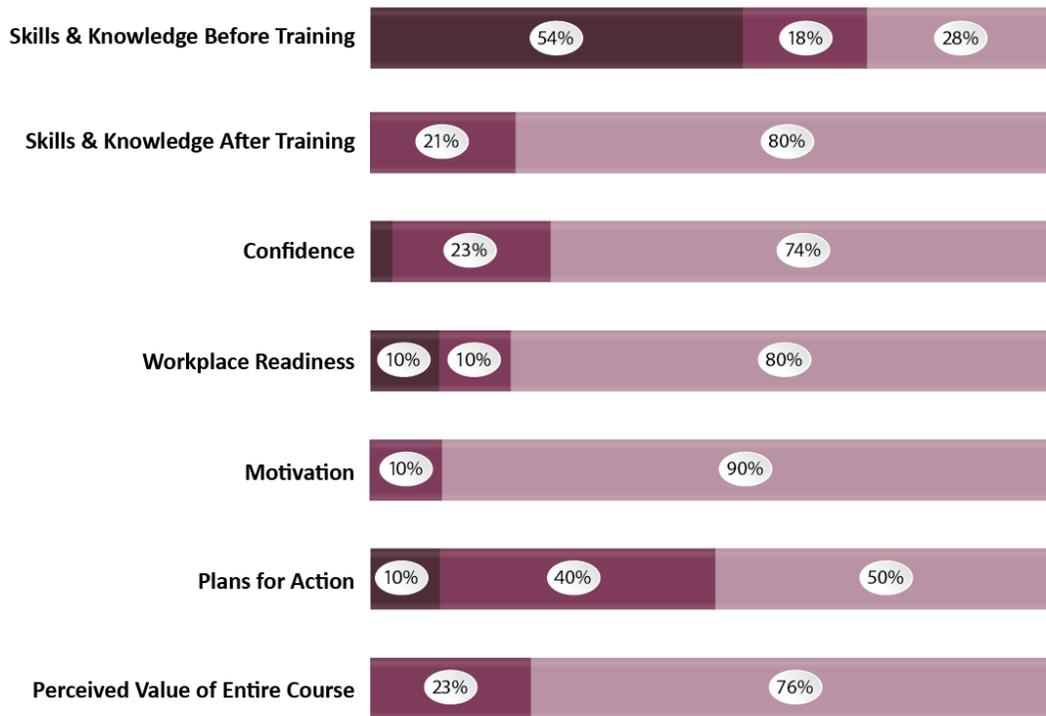


**RISK ALERTS** 🚩 more than half of participants report having a low or moderate level of knowledge and skill following training and 80% have low to moderate level of confidence in their ability to apply their learning. these findings suggest that participants may need more practice before successful job transfer is achieved. 🚩 half of the participants believe it will be possible to apply their training to a low to moderate degree in their specific job situation and 70% report having only a few or some ideas and plans for applying their learning.

## Part Two of the Course: Basic Plumbing Knowledge and Skills

### CFLI Capability Index: BCT Structures

■ **Low Rating:** 1 and 2 on a 5-point scale | ■ **Moderate Rating:** 3 on a 5-point scale | ■ **High rating:** 4 and 5 on a 5-point scale



**RISK ALERTS** 🚩 50% of participants report that they have only some or few plans and ideas for applying their learning. this may weaken job transfer.

### Transfer Results

**Evaluation Questions:** Did the work environment and learning strategy support the transfer of learning to the job? Did training participants apply their learning to their jobs, and did the application of learning impact their work or job performance?

To assess Transfer—the second link in the Learning Value Chain™—participants in the Plumber’s Training Program and their managers were asked to complete a Transfer Questionnaire (TQ) approximately six weeks following training. All participants responded to the questionnaires and three of their managers also completed questionnaires. See Figure 3.

The findings indicate that about half the group applied their mathematics and blueprints interpretation skills, but almost three-quarters demonstrated improved plumbing skills on the job

### Training encourages learning application and improves job performance outcomes.

The Transfer Index that follows summarizes these key results:

- **Learning Application:** 57% percent of participants reported a “high” level of learning application in the areas of mathematics and blueprint interpretation. The three managers tended to agree—especially in the area of calculating perimeters, areas, volumes, capacities, percentage and grade.
- **Performance Improvement:** 70% perceived improvement in basic plumbing skills on the job. Managers saw greatest improvement in the area of "installing and servicing non-metallic pipe and fittings."

### Effective Practices Enabling Transfer

The following strategies and practices were most frequently cited by participants as enabling the transfer of their learning:

- Support from manager or supervisor (7 mentions)
- Follow-up discussions or coaching (5 mentions)
- Sufficient level of knowledge and skill (5 mentions)

### Barriers to Learning Transfer

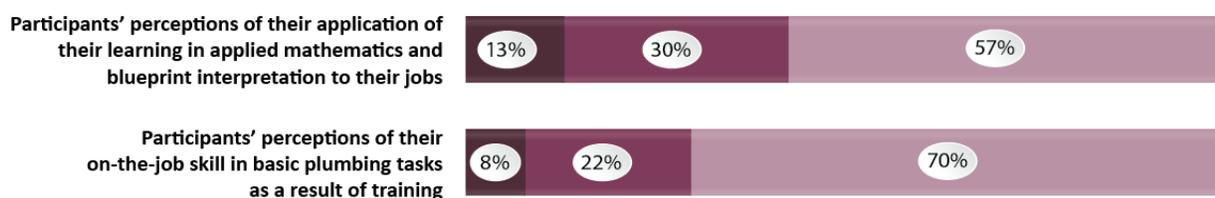
Participants varied widely in what they perceived as barriers to applying their learning. There appeared to be no one barrier significantly impacting the whole group.

#### Important Note

The data for this case study is based on a fairly small sample: ten employees participated in the training and responded to the questions on the Capability and Transfer Questionnaires. Given the small sample of learners, the results should be treated as 'suggestive' of the training's impact and not generalized to other training audiences.

## CFLI Transfer Index: BCT Structures Figure 3

■ **Low Rating:** 1 and 2 on a 5-point scale | ■ **Moderate Rating:** 3 on a 5-point scale | ■ **High rating:** 4 and 5 on a 5-point scale



## Organizational Results

**Evaluation Questions:** Did the application of learning or improvements to job performance impact business results? What were the intangible benefits from the training?

To assess the impact of the Plumber's Training Program on organizational results—the third link in the Learning Value Chain™—this study examined the business benefits that may have resulted from the training.

A central concern of BCT Structures management is ensuring the availability of a variety of skilled journeymen to help meet demanding production/assembly schedules often associated with large contracts. The cyclical nature of contract work means that at times there are critical requirements for certain skillsets while at other times there may be very little need for those same skillsets.

Adding to that, BCT faces resourcing challenges unique to the company's location and the cyclical dynamics of Alberta's oil-based economy. In boom times companies like BCT often experience stiff competition when attempting to hire certain skilled trades. The firm's Lethbridge facilities add additional impediments to accessing principal labour markets located at some distance in Calgary and Edmonton.

In the past, the lack of sufficient experienced journeyman plumbers often led to production bottlenecks and inflated project costs as schedule pressures require overtime and often the need to hire high-cost sub-contractors. The plumber's training program provided ten newly-skilled employees that could supplement BCT's existing plumbing team during times of high demand.

**The cost savings** Prior to implementing the training program, BCT management had estimated their 2014-15 contract commitments would require the hiring of three journeyman plumbers. As a result of having ten upskilled employees, BCT determined that they would now need to hire only one plumber. During peak demand, training participants, working in support roles with existing staff plumbers, were able to help BCT meet the contract workloads and stay on schedule.

The key financial benefits from the training, therefore, were the cost savings resulting from the organization avoiding the salary burden of having to hire two full time plumbers to meet ongoing contract demands. The cost savings is estimated to be the wage differential between the annual salary of the two journeyman plumbers and the upskilled production workers.

### Business Benefit

- Wage differential: 2X (Annual plumber salary – annual production worker salary)
- Plumber monthly salary = \$4,960
- Production worker monthly salary = \$3,046
- Annual Benefit = 2 X (\$4,960 - \$3,046) X 12 months = \$46,080
- **Total annual salary saving = \$46,080**

## Return on Investment

In order to calculate the return on investment the costs of developing the training and delivering the workshops was determined.

### Training Development Costs:

Since training participants attended the training after work hours, the training costs in this case are limited to the development and delivery costs.

- Total development cost (Lethbridge College): \$7,600
- Total in-house expense: 5 persons at \$50/hour (Shop rate)

= \$1,200

**Total training cost: \$8,800**

$$\begin{aligned} \text{ROI} &= \frac{\text{Total Benefit} - \text{Total Costs}}{\text{Total Costs}} \times 100\% \\ &= \frac{\$46,080 - \$8,800}{\$8,800} \times 100\% = 424\% \end{aligned}$$

### Return on Investment = 424%

(Note: It should be pointed out that the plumber training program relied on essential math skills for success. However, a substantial component of the program's success must also be credited to the plumbing trade skills acquired in the training.)

### Perceived Organizational Results

As another option for evaluating a program's ultimate impact, WLESR studies routinely examine the perceptions of managers and training participants on the business impact of the training. The perceived impact supports the strong business benefits actually achieved as a result of skill diversification.

Participants were surveyed approximately six weeks after training to determine the extent to which training had helped them achieve improved business results.

The majority of participants perceived the training as having a "high" impact on all business outcomes. Eighty percent perceived a high impact on "improving quality of work output" and 70% perceived high impact on "reducing labour shortage through diversification of skills" and "increasing plant output." Improved efficiency and improved safety in the plant were rated "high" by 60% of participants.

Two of the three managers perceived the training had improved efficiency and reduced labour shortage through diversification of skills to a "high" extent. All the managers reported that the training had improved work output to a "moderate" extent.

All participants and all managers agreed that the training had been a "worthwhile investment for BCT."

## Intangible Results

- **Employee ROI** Participants in the plumber training course also benefit financially from training in the form of anticipated future wage increases. BCT Structures rewards production staff with a competency-based compensation system that leads to higher wages as a function of skills attainment, job performance and on-the-job experience.
- **Eliminated Costs of Hiring Two Journeymen Plumbers**  
As a result of the plumber's training program, BCT was able to avoid the costs of hiring two journeymen plumbers which would otherwise have been necessary to meet anticipated production volumes. Typical BCT costs for advertising, testing, hiring, and onboarding a plumber average \$4,000 per tradesman.
- **Repeatable Trade Skills Formula** As a result of the plumber training program's success, BCT are now considering adopting the same peak-volume skills supplementation strategy with other production-critical trades such as electricians and carpenters.