Running head: REDESIGNING CURRICULUM FOR AVIATION MAINTENANCE APPRENTICES

Redesigning the Curriculum for Aviation Maintenance Apprenticeships:

Integrating Social and Reflective Practices

J. Scott Dixon

Simon Fraser University

Table of Contents

Abstract

Competencies have been used for many years to align the values, behavior, knowledge, and skills of individuals with the goals of the organizations in which they are employed. The organization in which I am employed in the role as a technical instructor, previously did not have a curriculum in place to support a competency based model for the apprentices who are working in an aviation maintenance capacity. This action research paper outlines the redesigned curriculum, grafting reflective and social learning aspects; the result of is intended to affect positive change in the learning practices of both the individual and organization.

Keywords: reflection, vocational education, apprenticeship, aviation maintenance

Introduction

The vocational world of aviation maintenance has been my domain for the last eighteen years and I have worked in a variety of roles in the same organization in this period of time. After completing an apprenticeship, I worked as an aviation maintenance technician and a lead hand prior to taking a management role in a production control capacity. Upon completing my Provincial Instructors Diploma five years ago, I transitioned into a new role as a technical trainer. This role was unsatisfying because I felt it neither addressed a valid organizational performance gap, nor did it breathe life into the learners that I was working with. This feeling of cognitive dissonance led to me pursuing a Masters degree in Education, where I could explore my own beliefs about learning and life. I tend to see myself as a pragmatic educator—and I find myself keenly interested in the usefulness and value of applied theory. When I learn a new theory or conduct research I ask myself 'what does this mean to me and where can I use this information to affect change?' This action research project is the result of this mindset.

My employer is a Transport Canada (TCCA) approved maintenance organization (AMO) licensed to perform maintenance, repair, and overhaul on high-bypass gas turbine engines. When required, my organization hires apprentices from BCIT's Gas Turbine Engine Overhaul (GTE) and Aircraft Maintenance Engineer (AME) programs. We currently employ eleven apprentices. A prerequisite of the apprenticeship is successful completion of the certificate program at BCIT, and the apprentice once hired is a full time permanent employee of the organization.

The current apprenticeship model is structured around a list of technical tasks within the organization, and each task is split into the two categories of 'observed' and 'participated'. The 'observed' field is signed for when the apprentice witnesses the task performed by a technically competent mechanic. This vicarious learning experience provides a foundation for future learning. The 'participated' field requires the apprentice to participate in the task and attempt

completion under the supervision of a journeyman technician. As the apprentice completes these tasks, they are signed for by licensed mechanics who oversee the correct accomplishment of the task.

Figure 1:

Example of apprentice task sign off

	Task	Observed	Participated	Supervisor
1	Install high pressure turbine			
2	Bolting And Torqueing Of Bolts			
3	Installation of flange brackets			
4	Removal Of turbine cases			

This model works well from a quality perspective, as it ensures that the airworthiness of the final product is guaranteed. Apprenticeships in aviation maintenance historically have focused on the technical skills and knowledge required to perform assigned work. This task based approach has been a model that has resulted in an industry of skilled and competent technicians with a highly successful track record with respect to quality and safety. The tacit knowledge required to perform a task however, is only one aspect of a competency-based approach to employee development, engagement, and flourishing. Illeris (2004) suggests that "learning activities should have the character of personal competencies, i.e. not merely knowledge, skills, and qualifications, but also the ability and the will to transfer them into appropriate actions in relation to relevant current and future situations and challenges"(p. 226). It is this approach that is at the heart of my revised curriculum; one not embedded in text, content, and learning objectives—but rather a curriculum that is a vision of living and learning through social and technical experiences. It is the bold concept of curriculum as culture. Joseph (2011) portrays this eloquently noting "curriculum conceptualized as culture educates us to pay attention to belief systems, values, behaviours, language, artistic expression, the environment in which

education takes place, power relationships, and most importantly, the norms that affect our sense about what is right or appropriate" (p.109).

Aviation maintenance can be described as a socio-technical discipline in that the work performed is the result of the complex and dynamic interplay between the people and technology. It is also an industry predisposed to action, and where things need to be accomplished correctly the first time, but this is not always the case. Hollnagel (2009) supports the concept when he notes "the idea of a socio-technical system is that the conditions for successful organizational performance – and conversely also for unsuccessful performance – are created by the interaction between social and technical factors" (p.18). I believe that there are not only organizational advantages with respect to quality, safety and efficiency with this revised curriculum, but personal benefits to the individual learner as well. I would even go as far as to argue that the personal development of the individual is indeed, the most critical aspect of any training program. When the learner 'buys-in' to what they are taught, when they see the value of application, and when they have the confidence and competence to succeed, everybody wins. Educational programs in industrial settings must consider the value and intelligence of the individual worker and consider the human factors that influence both successful performance as well as understanding and responding in a healthy way to human error. This must be done in a way that sustains self-and-spirit. People spend the majority of their lives working—and without a sense of value and fulfilment to enhance this experience, workers can quickly become demotivated. Worthen (2012) cautions us in this regard where workers must "do a job, control the pace and conditions of work enough to survive the job, and still have body and soul intact" (p.3). I believe the revised curriculum considers this perspective and fosters a sense of intrinsic motivation.

Although participation and mastery of technical skills are an essential part of a production focused industry, I believe that the previous model can be improved on by implementing a

curriculum based on a comprehensive and intentional designed learning experience focusing on the benefits of reflective practice and social learning. I believe that a holistic competency-based apprenticeship that includes all aspects of social learning has distinct advantages over the current task-based model. I have attempted to accomplish this by expanding the program to identify the knowledge, skills, behaviours and values that we expect apprentices to aspire to; and by integrating the practice of reflective thinking. Although this is an unorthodox approach to a technical discipline, I believe this reflective pause is a critical missing component from the socio-technical systems that exist in aviation maintenance work. Balesteros (2007) points out "it is necessary…to search for a formula of equilibrium between the philosopher's humanist Utopia and the engineer's machinist one" (p.155). This action research project is the result of seeking that balance.

Methodology

This participatory action research project is intended to affect positive change in the current apprenticeship through actively pursuing the following objectives:

1. Integrate the practice of reflectivity as a formal program component

2. Improve the apprenticeship experience through interactive coaching and mentoring.

3. Initiate social learning pedagogies practically in the workplace.

My action-research curriculum revision is not one based in text, as the apprentice program does not consist of learning plans, objectives, or outcomes. Rather, I believe that I can cultivate the values, behaviours, skill, and knowledge to support not only the organization, but to promote job satisfaction and self efficacy in apprentices. The curricular revision is focused primarily on changing the culture in the organization itself by fostering relationships and cultivating an

environment conducive to learning. By supporting the apprentice program with a curriculum that builds both confidence and competence, the organization as well as the individual will win in the long run. Conway and Foskey (2015) support this approach noting that "relational dynamics at work can promote or inhibit the apprentices' development, not just as a tradesperson developing skills, but also as a person whose needs for relatedness, autonomy, competence, and playfulness are being satisfied" (p345). I believe this can be accomplished through applying the curriculum revisions I am proposing, which consists of three distinct pedagogical approaches:

The first pedagogical strategy being utilized to support the concept of reflective practice is reflective journaling. I do not want their learning experience to be strictly focusing on the skills and knowledge required to accomplish a task, rather it is my intention that apprentices should learn to see the world as a complex, dynamic, and interactive social system. The previous task based model neglected the fostering of an awareness related to the conditions latent in the environment and teams they work in. I want the apprentices in this revised curriculum to ask themselves critical and complex questions and journal what they see and hear and think. Additionally, their thoughts and observations should mature over time, and this can be observed by what they record in the reflective journals. The following questions (as examples) demonstrate the increasing level of cognitive awareness and maturity I want to see in the reflective journaling as the apprentices mature in their profession:

- What *can I observe*

- What *should I be observing*

- What *am I thinking*

- What *can I improve*

- What *did I improve*

This approach to thinking is intended to bring to light the difficult theory of work-as-imagined as contrasted by work-as-performed, and is extremely useful in evaluating the effectiveness of the revised curriculum. This is supported by Weick (2005) who notes that work is an activity that occurs within a sensemaking framework. Weick (2005) reminds us that "plausibility rather than accuracy is the ongoing standard that guides learning; the concept of action suggests that it is more important to keep going than to pause, because the flow of experience in which action is embedded does not pause" (p. 419). Workers learn as they construct meaning; interpreting social, environmental, historical, and organizational cues. Workers settle for what makes sense to them at the time rather than struggling through the difficult process of considering what might be correct because reflection and socialization are not traditional values in the workplace. Reflective journaling provides a constructive means of processing thoughts, feelings, and observations; while providing a liminal space in our practice to hear our own voice.

The second pedagogical strategy of the revised curriculum is a formalized mentorship program in the organization. The mentors are encouraged to support the apprentices in a variety of ways. The most critical is to provide an environment that is conducive to learning. Vicarious learning is a natural process that occurs in any social setting. We observe what others do, and evaluate the responses to the observed actions. It is for this reason that I believe that mentors in technical disciplines do not have to be the most experienced people as has traditionally been the case. Rather, I propose that the mentor should be a person who is in alignment with the organizational view of culture, behaviour, beliefs, and values. I believe that holistic competency should outweigh technical expertise in mentorships. Encouraging curiosity and guiding the apprentices to practice critical thinking skills are key elements that I have instructed the mentors to focus on. Promoting the concept of stopping and thinking, systems thinking, and acknowledging the intelligence of the worker as an agent of change are central themes. Vaughan

(2016) notes that in order to address what she coins as "normalization of deviance", we need to

adopt a way of thinking that goes beyond focus on skill and knowledge. Vaughan (2016) notes

"What matters in developing an anthropology of organizations is that we go beyond the obvious

and grapple with the complexity, for explanation lies in the details" (p. 463). Details matter and I

believe that our orientation towards action is better served when we consider work not as a task,

but as an activity in a system. Apprentices need to learn how to think about the complex nature

of social technical work from a systems thinking perspective, and approach learning through

inquiry. This can be guided by the mentors as the mentor-mentee relationship is the key to

building trust and cultivating a community where this type of learning is prioritized. However,

the mentors themselves should additionally be open to giving and receiving feedback from the

program stakeholders. Mentors are key stakeholders and valuable qualitative data can be gleaned

from interviews and focus groups. Successful mentorships need careful management involving

all stakeholders, and this includes not only the apprentices, but also the program sponsor and

management within the organization.

The third and final pedagogical strategy is the implementation of a community of practice

for the apprentices. This unscripted weekly meeting is 'owned' by the apprentice team and is

used as a forum for sharing learning experiences (both positive and negative) and allows for a

safe environment to encourage social learning. Although there are eleven apprentices currently

working in my organization, without the community of practice meeting, there would be very

little interaction between them. This is due to the fact that we are physically a large company,

and the apprentices are distributed to several different areas. This weekly learning experience

encourages the apprentices to participate actively—reflecting not in silence and isolation but

finding the courage to say "this is what I have discovered…". Learning requires conversation,

emotion, imagination and social interaction between the learners (Elkjaer, 2009). Although there

is a strong component of social learning that takes place in the mentorship program discussed previously, the conversations and learning experiences between peers will be of a different nature. Learning in the workplace is not a scripted event that occurs in the classroom, but is the result of living, acting, and conversing with others (Wenger, 2009).

Literature Review

The concept of competencies was first introduced in a journal article by McClelland (1973) where he proposed that test scores were poor indicators of performance. He argued that criterion referenced testing was a more appropriate method to use and should be specific to the skills and knowledge that are identified as required to perform a specific task. The concept has evolved over the last forty years and has found a home not only in education, but also in business. Competencies have been defined by Lucia & Lepsinger (1999) as "the particular combination of knowledge, skill, and characteristics needed to effectively perform a role in an organization"(p. 5). I have expanded this concept in my revised curriculum to look beyond strictly skill and knowledge competencies, with special consideration to sensemaking and constructivism. Illeris (2004) reinforces this approach when he states that "competence does not consist of the learning content alone, but also encompasses the way in which one can make use of this content in known and not least unknown contexts, the way in which one relates to it, and how it plays a part in one's self-perception and possibilities for action" (p.89). The idea of being competent goes beyond having the skill and knowledge required to perform a task, and should consider the constructivist approach and recognize that learners construct meaning through social experiences in addition to performing work itself. Constructivism refers to the social theory of learning where the learner creates knowledge by interacting with other individuals, and where values and knowledge are intertwined. Kegan (2009) provides guidance when considering this approach

where he outlines "changes in one's fund of knowledge, one's confidence as a learner, one's self perception as a learner, one's motives in learning, one's self-esteem—these are all potentially important kinds of change, all desirable, all worthy of teachers thinking about how to facilitate them" (p.132).

Aviation is a high risk industry. As such, we find ourselves preoccupied with error—maintaining a focus on ensuring that things go right as often as possible (Dekker, 2006). We are fixated on risk not because of our poor track record, but because of the potential consequences when things do go wrong. Organizational learning—especially in high risk industries cannot exist apart from individual learning. Lawson (2001) promotes 'slack-time' as beneficial to high risk industries, noting "where failure is not an option, but where all complex interactions cannot be known or even anticipated…constant vigilance and learning must be recognized as central organizational activities" (p. 133). Error culture itself is a factor that needs to be considered when exploring learning models such as the one I have proposed. Workers do not come to work with the intent of making mistakes (Dekker, 2006). If we value safety we need to improve the systems that we work in, then this has to be embedded in the mindset of the workers. Employees should be encouraged to challenge assumptions, norms, and ask for clarification when confronted with vague instructions. Employees should also feel confident and supported to stop when confusion arises, and know where to seek help, even at the cost of production. Gavin (1993) notes that learning needs to be viewed as an organizational priority when he observes;

employees must therefore become more disciplined in their thinking and more attentive to details. They must continually ask 'how do we know that's true?', recognizing that close enough is not good enough if real learning is to take place. They must push beyond

obvious symptoms to assess underlying causes, often collecting evidence when

conventional wisdom says it is unnecessary" (p. 81).

This reflection-in-action approach to learning in industrial settings is already being promoted by

organizations such as Eurocontrol who is the organization responsible for safety of air navigation

in Europe. Field expert involvement is a concept that is considered critical when addressing

theories of organizational change, management, and safety (Eurocontrol, 2014). Field expert

involvement only works if you involve them. Input from these experts can only efficiently be

utilized when organizations allow time to consider questions such as; what works? What doesn't?

Where are the weak points and strong points in the systems I am a critical part of? Eurocontrol

(2014) encourages employees in high risk industries to "reflect on your mindset and assumptions.

Reflect on how you think about people and systems, especially when an unwanted event occurs

and work-as-done is not as imagined. A mindset of openness, trust and fairness will help you

understand how the system behaved" (p. 13). This reflection creates sparks of imagination,

curiosity, self-perception, and compliments the concept of self efficacy. This needs to be a lived

organizational value, constructed as a learning experience in the earliest days of employment.

The centerpiece of the revised curriculum is the integration of the practice of reflectivity

as a formal component of the apprenticeship. I believe that the concept of reflectivity is

beneficial for the entire organization, and supports the concept of a competency based program.

Apprenticeships that focus primarily on technical skills do not typically promote the practice of

critical self-reflection. Unless there is a deliberate and intentional process in place that forces us

to consider the beliefs, values, norms, culture, thoughts and observations we may have about the

complex and dynamic systems we work in—we can never act on these very implicit factors. I

believe that reflective journaling is an appropriate method of introducing this in an aviation apprenticeship curriculum, and that over time this practice will result in unique benefits.

I believe we need to take advantage of both the concepts of reflection-in-action and reflection-on-action outlined by Schön (1983), and that there can be benefits to high reliability organizations when they integrate the concept of reflective practice. The industry cannot afford to focus strictly on the technical concepts and ignore the cognitive, cultural, or social ones. Kinsella (2010) notes that "we need to develop a broader conception of professional knowledge, one that recognizes the limits and potential dangers of a sole focus on technical rationality and calls for a more complex vision of knowledge for practice" (p.568). This can be accomplished by integrated tools to support the constructive learning process such as communities of practice, reflective journaling, and mentorships.

Illeris (2004) reminds us that "learning takes place in a dynamic relation between the employees' learning processes, the communities at the workplace and the enterprise as technical-organisational system" (p.431). I believe that reflection is a critical missing element that can tie together these elements in aviation maintenance apprenticeships. This can be addressed by encouraging pauses in practice, where we stop, think, and discuss. Lawson (2001) refers to this as 'slack-time' where he notes that "learning organizations require slack in the form of time to develop, and time for learning must be part of the organizations design…learning is difficult when employees are harried or rushed; it tends to be driven out by the pressures of the moment" (p. 10). Reflection is an excellent way to explore the dichotomy between work-as-performed and work-as-imagined. This pause in action allows us to consider the reality of practice and consider the consequences of continuing when we perceive risk. Johns (2000) supports this where he notes "through the conflict of contradiction, the commitment to realize desirable work and

understanding why things are as they are, the practitioner is empowered to take more appropriate action in future situations" (p. 34). Learning must be seen as an organizational priority.

Critical Review

The greatest objection to developing a reflective and socially oriented constructivist curriculum in industry is the perceived loss of productivity. Having employees participate in reflective journaling and attending meetings without an agenda are bold and risky activities for any production driven environment. Lawson (2001) validates this concern when he warns us that slack time in organizations is often seen as wasteful. Lawson (2001) warns us "if learning is not considered one of the organization's core activities, the slack required to enable people to think and discuss, and for learning groups to emerge, is vulnerable to being eliminated in the name of efficiency" (p.8). This should be no surprise. Any organization whose core business activities involve production can be characterized by its tendency to be action oriented. Eliminating waste and maximizing throughput are frequently the preferred focus, although rhetorical and conflicting language can sometimes create confusion. Idle time in any form is frequently and understandably viewed as wasteful or counter-productive. Over time, this mindset becomes an organizational norm; an embedded part of culture which is difficult to counter. In organizations that focus on process improvement driven methodologies the concept of efficiency is the central mental model they have formed. This is because the way we think and what we think about becomes habitual, and challenging our own assumptions and beliefs is difficult.

Apprenticeships historically have focused on the skills and knowledge required to learn a vocation and apprenticeship models have proved to be very successful at producing highly skilled craftsmen. Within a short period of time these young workers are professional technicians accountable for their own work. Changes to this successful model may be viewed as unnecessary,

as it is perceived to be working so well. Why change something that works? Change always is difficult and resistance to this change is a valid risk. Additionally, organizational initiatives such as continuous improvement have successfully proved to be effective vehicles for process change. Organizations may ask themselves 'Why bother with the newest workers with the least experience when we have professional initiatives such as these in place?' Unfortunately, improvement initiatives can frequently neglect the human experience and understanding of work-as-performed (Balesteros, 2007, Gavin, 1993, Lawson, 2001). Balesteros (2007) cautions us on this point when he warns "instead of paying attention to the operator's understanding of meaning, organizational evolution has centered itself on operational improvements. The lack of attention to the human actors and their need to assign meaning to actions has led to a progressive deterioration of this variable"(p.162). Gavin (1993) also raises this as a concern when he speculates that learning should be prioritized over improvement.

Organizational culture is another factor that may inhibit the practice of critical reflection on the part of the worker. There are several factors to consider in this regard such as union-management relationships, issues of power, perception of the worker, and the concept of open and honest communication come to mind. Mezirow (1998) highlights the ways this manifests in organizations stating:

Organizational norms that commonly inhibit critically reflective learning include: let failures lie; keep your view of sensitive issues private; enforce the taboo against public discussion; do not surface and test differences concerning organizational problems; avoid seeing the whole picture so one does not see how problems are connected; protect yourself by avoiding interpersonal confrontation and public discussion of sensitive issues;

> protect others in the same way; control the situation by making up your own mind and
>
> keeping it private; and avoid public dialogue that might refute your view. (p. 194)

If the culture of a workplace includes any of the problematic characteristics discussed above it would be difficult to implement a curriculum consisting of these non-traditional elements. If this is this case, then frank discussions backed by research need to be held to address the cultural mindset and framing of the organization itself. If learning is not acknowledged as an organizational priority that creates value, and employees are not freed up to learn then this initiate is doomed to fail from the start. Gavin (1993) reminds us that "learning is difficult when employees are harried or rushed; it tends to be driven out by the pressures of the moment. Only if top management explicitly frees up employees' time for the purpose does learning occur with any frequency" (p. 91). It is also important to consider resistance at the other end of the organization, as resistance may happen within the apprenticeship participants themselves. An individual who wants to work as a mechanic may go through the motions while in the program, but the concept of reflection may fail to take root and persist as a way of working when they become a journeyman technician. In summary, the critical aspects of the revised curriculum largely depend on how the organization views its workforce. Wenger (2009) muses that if employees are "diligent implementers of organizational processes" (p. 611) then the solution to efficiency, safety, and quality can be found in process design. However, if people accomplish their goals through a sensemaking process that can never be effectively documented, then we need to develop communities that can think, reflect, adapt, and respond to change (Wenger, 2009).

Conclusion

I think that Senge (2006) provides a vision for how things could be that aligns with my revised curriculum when he notes that "organizations learn only through individuals who learn. Individual learning does not guarantee organizational learning. But without it, no organizational learning occurs"(p. 139). Technical trades have historically provided a focus on the technical aspects of job related skill development. Aviation is no exception, and training has been following traditional models for many years. It is my premise that in order to improve safety and quality in this high risk industry, we must revisit the training models we subscribe to. Ballesteros (2007) acknowledges this when he notes that "air safety is a field where the need for new learning is greater than that which the current model can provide and a new, alternate model should be developed" (p. 162). I believe that although the previous model for apprenticeships in Approved Maintenance Organizations (AMOs) is effective at addressing the skills and knowledge required to develop apprentices into maintenance engineers, we are missing the elements that address values, beliefs and behaviors that are considered important to the industry. I believe that an apprenticeship in an aviation maintenance environment should include, improve, and can have a positive influence the following:

- Awareness and alignment with values and behaviours prized by the aerospace industry

- Sense of belonging and meaning in the organization as an employee and member of a team in a high-risk organization

- Sense of job satisfaction and work-life balance

- Demonstrated competence in job-based skill and knowledge

- Introduction of metacognitive components such as reflectivity

It is my belief that we can achieve a mindset of organizational learning, personal competence, and improved quality and safety when we focus on building relationships, investing in building

communities of learning in the workplace, and through a curriculum including reflective discourse. Schön (1983) acknowledges that in any organization there is going to be a difference between the neat and tidy world of research, theory, and work-as-imagined, and the messy swamp where people struggle to construct meaning and apply theory at the sharp end of the social-technical systems we work in. By investing in the lives of the worker at the earliest stages of their careers, we build into our systems a cycle of organizational learning. It is only when we make intentional efforts to understand work-as-performed by the worker at the sharp end that change to culture can take hold. Schön (1983) was keenly aware of this dichotomy and provides a clue on how to proceed; "the difficulty is that the problems of the high ground, however great their technical interest, are often relatively unimportant to clients or to the larger society, while in the swamp are the problems of the greatest human concern" (p.42). This revised curriculum presents an unorthodox constructivist approach to learning in the setting of a conventional technical discipline. However, I believe we can build safer systems and foster organizational learning more effectively when we recognize the true value of those who are learning how to learn. Everybody wins when we promote creativity, imagination, joy, a sense of belonging, community, and a learning culture. We spend the majority of our adult lives in the workplace—so let's build a workplace worth living in.

References

Ballesteros, J. (2007). *Improving air safety through organizational learning.* Burlington, VT:

    Ashgate.

Conway, M., & Foskey, R. (2015). Apprentices thriving at work: looking through an appreciative

    lens. *Journal of Vocational Education & Training*, 67 (3), 332-348.

Elkjaer, B. (2009). Pragmatism. In Illeris, K. (Ed.), *Contemporary theories of learning* (p.216-

    303). [iBook version]. Retrieved from http://www.apple.ca/itunes

Eurocontrol. (2013). From safety-I to safety-II: A white paper. Retrieved from

    http://www.skybrary.aero/bookshelf/books/2437.pdf

Gavin, D. (1993). Building a learning organization. *Harvard Business Review,* July-August 1993,

    78-91.

Hollnagel, E. (2009). *The ETTO principle: Efficiency-thoroughness trade-off.* [Kindle-DX

    version]. Retrieved from Amazon.com

Illeris, K. (2004). *Adult education and adult learning.* Miami Beach, FL: Krieger Publishing

    Company.

Illeris, K. (2004). A model for learning in working life, *Journal of Workplace Learning*, 16 (8),

    431-441.

Johns, C. (2000). *Becoming a Reflective Practitioner.* Blackwell Science: Oxford.

Joseph, P. (2011). *Cultures of curriculum*. [iBook version]. Retrieved from

    http://www.apple.ca/itunes

Kegan, R. (2009). What "form" transforms. In Illeris, K. (Ed.), *Contemporary theories of learning* (p.110-158). [iBook version]. Retrieved from http://www.apple.ca/itunes

Kinsella, E. (2010). The art of reflective practice in health and social care: reflections on the legacy of Donald Schön. *Reflective Practice,* 11(4), 565-575.

Lawson, M. (2001). In praise of slack: Time is of the essence. *IEEE Engineering Management Review,* 15 (3), 4-13.

Lucia, D., & Lepsinger, R. (1999*). The art and science of competency models.* San Francisco, CA: Jossey-Bass/Pfeiffer.

McClelland, D. (1973). Testing for competence rather than for "intelligence". *American Psychologist,* January 1973.

Mezirow, J. (1998). On critical reflection. *Adult Education Quarterly*, 48 (3), 185-198.

Schön , D. (1983). *The reflective practitioner.* New York, NY: Basic Books.

Weick, K., Sutcliffe, K., & Obstfeld, D. (2005). Organizing and the process of sensemaking. *Organizational Science,* 16 (4), 409-421.

Wenger, E. (2009). A social theory of learning. In Illeris, K. (Ed.), *Contemporary theories of learning* (p.594-621). [iBook version]. Retrieved from http://www.apple.ca/itunes

Worthen, H. (2012). A different curriculum of preparation for work: commentary on Mike Rose, Sara Goldrick-Rab, Kris Gutierrez, and Norton Grubb. *Mind, Culture, and Activity*, 19, 190-195.

Appendix A: TCPS 2: CORE Certificate

PANEL ON RESEARCH ETHICS
Navigating the ethics of human research

TCPS 2: CORE

Certificate of Completion

This document certifies that

Jason Dixon

has completed the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans Course on Research Ethics (TCPS 2: CORE)

Date of Issue: **16 January, 2017**